STAR

SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

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SEPTEMBER 8, 1971

VOLUME 9 • NUMBER 17

N71-29201—N71-30400

PUBLIC DOCUMENTS

SEP 21 1971

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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PUBLISHED BY:
UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION OFFICE
Scientific and Technical Aerospace Reports, Volume 9, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

Use of funds for printing this publication approved by the Director of the Office of Management and Budget August 31, 1970.

INTRODUCTION

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2702**

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Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories. **2727**

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Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. **2775**

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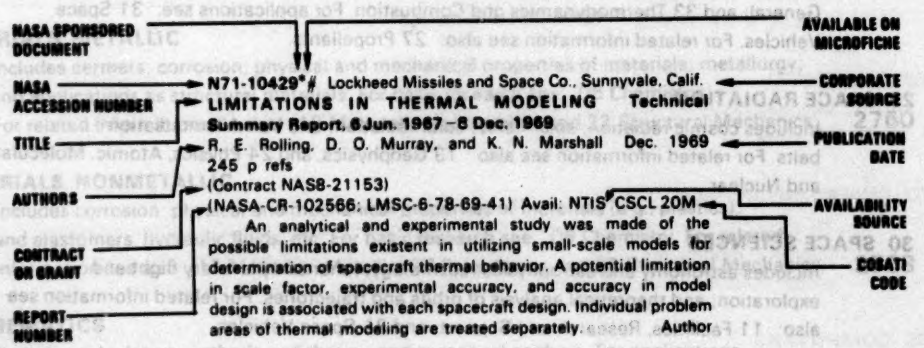
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LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 6 Dec. 1969
AUTHORS
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
PUBLICATION DATE
245 p refs
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AVAILABILITY SOURCE
An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
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VOLUME 9 NUMBER 17 / SEPTEMBER 8, 1971

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-29221*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
UNSTEADY AIRFOIL STALL AND STALL FLUTTER
Lars E. Ericsson and J. Peter Reding Jun. 1971 135 p refs
(Contract NAS1-9987)
(NASA-CR-111906; LMSC-A-6J-71-1) Avail: NTIS CSCL 01A

The unsteady airfoil stall characteristics are described analytically using static experimental data as an input. It is found that the dynamic overshoot of static stall does not in itself generate any time lag above the Karman-Sears wake lag. It is the post stall aerodynamic forces that create an additional time lag, which is dominant at high frequencies. The analytic theory is found to predict dynamic loops and measured negative damping as long as the frequency is not very large. In the latter case, a graphical method for modulation of the separation induced phase lag gives improved agreement with experimental data. The effects of compressibility and shock-induced boundary layer separation are included in the analysis, and it is shown that the experimentally determined stall flutter boundaries of a space shuttle wing can be predicted using only static data as an input. Author

N71-29318# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
COMPRESSIBLE TURBULENT BOUNDARY LAYER PREDICTIONS
Robert M. Nerem [1970] 19 p refs Sponsored by SRC
(IC-AERO-70-05) Avail: NTIS

The relatively few theoretical methods of predicting the growth of a compressible turbulent boundary layer with heat transfer are examined. Heat transfer data obtained from flat plate tests in a gun tunnel at Mach numbers 3 and 9 are compared with a number of empirical correlations. Author (ESRO)

N71-29333# Advisory Group for Aerospace Research and Development, Paris (France).
SYMPOSIUM ON UNSTEADY AERODYNAMICS FOR AEROELASTIC ANALYSES OF INTERFERING SURFACES, PART 1
April 1971 92 p refs Held at Tonsberg, Norway, 3–4 Nov. 1970
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4. A SUPERSONIC BOX COLLOCATION METHOD FOR THE CALCULATION OF UNSTEADY AIRFORCES OF TANDEM SURFACES D. L. Woodcock and E. J. York (Royal Aircraft Estab., Farnborough, England) 26 p refs (See N71-29337 17-01)

N71-29334# Stanford Univ., Calif.
SOME CONSIDERATIONS RELATIVE TO THE PREDICTION OF UNSTEADY AIR LOADS ON INTERFERING SURFACES
H. Ashley *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 1 Apr. 1971 22 p refs (See N71-29333 17-01)
Avail: NTIS

Loading singularities inherent in linearized potential theory are classified as local, in the sense that both the nature and magnitude of the singularity are determined by boundary conditions in the inner field; or global, in the sense that the entire boundary value problem must be solved to determine their details. Available results are reviewed relative to discontinuities in surface slope, planform shape, dihedral angle, etc., and suggestions are offered for combining them into numerical solution schemes. With respect to the analysis of interfering lifting surfaces, selected recent activity in the United States on continuous solution of various subsonic and supersonic cases is described. Regarding the area-element or box approach to the latter, it is recommended that an element in the form of a trapezium, similar to that employed by Woodward for steady flow, will also improve the behavior of predicted loads for oscillatory motion of interacting surfaces. Formulas for certain of the required influence coefficients are developed. Some nonlinear effects are examined which are felt to have greater significance for interference problems than for isolated lifting wings. The phenomena include the normal displacement and self-deformation of wakes which induce loads on aft surfaces, the local influences of profile thickness, and displacement due to boundary layer growth. Author

N71-29335# Royal Aircraft Establishment, Farnborough (England).
CALCULATION METHODS FOR UNSTEADY AIRFORCES OF TANDEM SURFACES AND T-TAILS IN SUBSONIC FLOW
D. E. Davis *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 1 Apr. 1971 22 p refs (See N71-29333 17-01)
Avail: NTIS

The basis of numerical methods, using continuous distributions of loading, for evaluating oscillatory generalised airforce coefficients for interfering and intersecting surfaces inclined everywhere at small angles to a subsonic mainstream flow is described. Particular application to tandem surfaces and T-tails is discussed briefly. Author

N71-29336# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
REPRESENTATION OF A WING IN THE LIFTING LINE; APPLICATION OF THE INTERACTION CALCULATIONS OF TWO WINGS IN TANDEM [REPRESENTATION D'UNE AILE PAR DES LIGNES PORTANTES; APPLICATION AU CALCUL DE L'INTERACTION DE DEUX AILES EN TANDEM]
R. Dat and Y. Akamatsu *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 1 Apr. 1971 17 p refs In FRENCH; ENGLISH summary (See N71-29333 17-01)
Avail: NTIS

The simulation of wings by a lattice of lifting lines is summarized for the computation of unsteady aerodynamic forces on combinations including several lifting surfaces, such as wing-horizontal tail or fin-horizontal tail. It can be considered as a compromise between the doublet lattice method which is advantageous for its flexibility, and the so called lifting surface method whose results are more accurate for a given number of collocation points. A numerical program was developed for the application to wings lying in two parallel planes. The particular features of the method of calculation are presented, as well as some numerical results. Author

N71-29337# Royal Aircraft Establishment, Farnborough (England).
A SUPERSONIC BOX COLLOCATION METHOD FOR THE CALCULATION OF UNSTEADY AIRFORCES OF TANDEM SURFACES
D. L. Woodcock and E. J. York *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 1 Apr. 1971 26 p refs (See N71-29333 17-01)
Avail: NTIS

A box collocation method is developed for the determination of the airforces on a pair of tandem surfaces (not necessarily coplanar) undergoing small oscillatory displacements in a supersonic flow. The perturbation velocity potential is evaluated at the vertices of a lattice of Mach lines on each wing. The results of the application of the method to a wing-tailplane configuration each of triangular planform, are given. Author

N71-29338# Advisory Group for Aerospace Research and Development, Paris (France).
SYMPOSIUM ON UNSTEADY AERODYNAMICS FOR AEROELASTIC ANALYSES OF INTERFERING SURFACES, PART 2
Apr. 1971 234 p refs Held at Tonsberg, Norway, 3–4 Nov. 1970
(AGARD-CP-80-71) Avail: NTIS

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7. SOME RECENT INVESTIGATIONS ON FLUTTER IN SUBSONIC FLOW, CAUSED BY INTERFERENCE AERODYNAMIC FORCES BETWEEN WING AND TAIL OF A VARIABLE GEOMETRY AIRCRAFT W. Seidel and O. Sensburg (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich, West Germany) 10 p refs (See N71-29345 17-01)

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9. APPLICATION OF LIFTING SURFACE THEORY TO WINGS PROVIDED WITH CONTROL SURFACES B. Darras and R. Dat (Office Natl. d'Etudes et de Recherches Aerospatiales, Paris, France) 14 p refs (See N71-29347 17-01)

10. UNSTEADY AIRFORCES FOR WINGS WITH CONTROL SURFACES PART 1: LOADING FUNCTIONS B. L. Hewitt (British Aircraft Corp., Warton, England) 26 p refs (See N71-29348 17-01)

11. UNSTEADY AIRFORCES FOR WINGS WITH CONTROL SURFACES PART 2: CALCULATION METHODS B. L. Hewitt (British Aircraft Corp., Warton, England) 24 p refs (See N71-29349 17-01)

12. PRESSURE MEASUREMENTS ON AN HARMONICALLY OSCILLATING SWEPT WING WITH TWO CONTROL SURFACES IN INCOMPRESSIBLE FLOW H. Forsching, H. Triebstein, and J. Wagener (Deutsche Forschungsund Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen, West Germany) 15 p refs (See N71-29350 17-01)

N71-29339# Vereinigte Flugtechnische Werk-Fokker G.m.b.H., Munich (West Germany).
SUBSONIC UNSTEADY AIRLOADS ON MULTIPLE LIFTING SURFACES
G. Boehm and H. Schmid *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfacing, Part 2 Apr. 1971 28 p refs (See N71-29338 17-01)
Avail: NTIS

A survey is presented of the main features of lifting lattice methods and particularly of lifting surface methods. Ways to extend existing methods to arbitrary lifting surface configurations are also discussed. The following is a short description of these fundamentals and a detailed discussion of the numerical methods as established by the authors. Results obtained will be presented and compared with other theories. Author

N71-29340# Douglas Aircraft Co., Inc., Long Beach, Calif.
NEW DEVELOPMENTS AND APPLICATIONS OF THE SUBSONIC DOUBLET-LATTICE METHOD FOR NONPLANAR CONFIGURATIONS
W. P. Rodden, J. P. Giesing, and T. P. Kalman *In* AGARD Symp.

on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 28 p refs (See N71-29338 17-01)
Avail: NTIS

Procedures for calculating the normalwash induced by a doublet line in nonplanar configurations and for calculating the interference between wings and bodies are given. Applications are made to a non-coplanar wing-tail combination, a number of empennage configurations, a wing-fuselage and a wing-nacelle combination. Also considered is the calculation of velocity components in the flow field during oscillatory motion and the calculation of the distribution of induced drag in steady flow. Examples of both calculations are also presented. Author

N71-29341# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
APPLICATION OF AFFDL UNSTEADY LOAD PREDICTION METHOD TO INTERFERING SURFACES
W. J. Mykytow, J. J. Olsen and S. J. Pollock *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 24 p refs (See N71-29338 17-01)
Avail: NTIS

The results of engineering applications of subsonic and supersonic lifting surface methods to some of the AGARD configurations and other interesting configurations, are presented. The subsonic kernel function program is applied to several aspects of the wing-tail interaction problem. The subsonic double lattice method is also applied to the problem. Results are also presented for a supersonic Mach box program developed for T-tails and cruciform tails along with comparisons with piston theory. Comparison between the subsonic kernel function and the doublet lattice method is generally quite good. While the double lattice method usually required greater computing times for the same accuracy as the kernel function method, it has some advantages in its favor such as ease of application and extension to more complicated configurations. The supersonic results presented here appear to be of the proper order of magnitude when compared with piston theory, however, more applications and careful checking are indicated. Author

N71-29342# Royal Aircraft Establishment, Farnborough (England).
APPLICATIONS OF UNSTEADY AIRFORCE CALCULATION METHODS TO AGARD INTERFERENCE CONFIGURATIONS
D. E. Davies *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 18 p (See N71-29338 17-01)
Avail: NTIS

Calculations of generalised airforce coefficients were carried out for the configurations of wing and horizontal tail and of fin and horizontal tail oscillating in subsonic flow in prescribed modes at given frequencies. Author

N71-29343# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MEASUREMENT OF UNSTEADY AIR LOADS OF INTERACTION BETWEEN LIFTING SURFACES IN TANDEM [MESURES DES FORCES INSTATIONNAIRES D'INTERACTION ENTRE SURFACES PORTANTES EN TANDEM]
A. Destuynder *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 12 p refs In FRENCH; ENGLISH summary (See N71-29338 17-01)
Avail: NTIS

A series of wind tunnel tests were performed in view of analyzing the influence of several parameters on the aerodynamic interference between two lifting surfaces in tandem. The aim was to determine the magnitude of the coupling terms in order to provide a theoretical explanation of the flutter instabilities occurring on variable sweep airplanes. The tests were limited to two types of motion: pure translation and pure pitching oscillation of one wing. The model consisted of two rectangular or swept wings whose relative position could be adjusted continuously in the horizontal as well as in the vertical direction. Some comparisons between theory and experiment are given. Author

N71-29344# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Munich (West Germany).
T-TAIL AEROELASTIC ANALYSIS FOR FOKKER F.28
J. Yff and R. J. Zwaan (Natl. Aero and Astronautical Res. Inst.) *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 15 p refs (See N71-29338 17-01)
Avail: NTIS

Data from an aeroelastic and flutter analysis are presented. The data include lateral gust loading, aircraft designs, and mission analysis. The results indicate that mass balancing of the rudder and aileron may be deleted, testing time for high speed flutter may be reduced, and the risks of extensive modifications to the design may be reduced. The tests also achieved the certification of the aircraft. E.H.W.

N71-29345# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
SOME RECENT INVESTIGATIONS ON FLUTTER IN SUBSONIC FLOW, CAUSED BY INTERFERENCE AERODYNAMIC FORCES BETWEEN WING AND TAIL OF A VARIABLE GEOMETRY AIRCRAFT
W. Seidel and O. Sensburg *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 10 p refs (See N71-29338 17-01)
Avail: NTIS

A method for routine flutter calculations utilizing interference aerodynamic forces between wing and tail is presented. The elastomechanic system of the aircraft is described by branch modes and the airforces for these branch modes are produced by superimposing air forces for arbitrary polynomials. The air forces are calculated for a distinct vertical offset between wing and tail with the exact kernel functions. A large variety of stiffness parameter variations was performed such as wing stiffness, fuselage stiffness and tailplane connection stiffness in order to get a better understanding of the flutter phenomenon involved and to find a cure for solving the problem. Some of the results are compared with results from wind tunnel model tests to establish the validity of the analytical method used. Author

N71-29346# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
UNSTEADY AERODYNAMICS FOR WINGS WITH CONTROL SURFACES
H. Tijdeman and R. J. Zwaan *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 15 p refs (See N71-29338 17-01)
Avail: NTIS

A kernel function method to calculate pressure distributions over wings with harmonically oscillating control surfaces in subsonic flow is briefly discussed. Comparisons of calculated and measured pressure distributions are given for different planforms, Mach numbers and reduced frequencies. An analysis is given of pressure distributions measured at high subsonic and transonic Mach numbers. Author

N71-29347# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF LIFTING SURFACE THEORY TO WINGS PROVIDED WITH CONTROL SURFACES [APPLICATION DE LA THEORIE DE LA SURFACE PORTANTE A DES AILES MUNIES DE GOUVERNES]

B. Darras and R. Dat *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 14 p refs In FRENCH; ENGLISH summary (See N71-29338 17-01)
Avail: NTIS

A method for solving the problem of control surfaces in subsonic unsteady flow is considered. It is based on the explicitation of the logarithmic singularity of the pressure field and on an analysis of the usual matrix solution of the integral equation. This method, whose application to a rectangular wing has already been described, is extended here to an arbitrary planform. The comparison of experimental and theoretical results obtained for the rectangular wing is also shown. Author

N71-29348# British Aircraft Corp., Warton (England).
UNSTEADY AIRFORCES FOR WINGS WITH CONTROL SURFACES. PART 1: LOADING FUNCTIONS
B. L. Hewitt *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 26 p refs (See N71-29338 17-01)
Avail: NTIS

An attempt was made, through the use of matched asymptotic expansion techniques, to define methods for finding the inner singular pressure loading functions associated with a wide variety of interaction effects on wings with unbalanced control surfaces. The work is basic in that it facilitates the construction of adequate loading forms which are necessary before attempting to obtain convergent lifting surface theory solutions. It extends the practical scope of Landahl's work and gives, as a result, sound reasons for modifying the loading recipes. Author

N71-29349# British Aircraft Corp., Warton (England).
UNSTEADY AIRFORCES FOR WINGS WITH CONTROL SURFACES. PART 2: CALCULATION METHODS
B. L. Hewitt *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 24 p refs (See N71-29338 17-01)
Avail: NTIS

Using the local loading solutions, a numerical method is described which accurately evaluates the associated discontinuous downwash distribution, w(2), for steady flow. W(2) is then regularised through the specified boundary conditions to give w(1), which can then be used to gain converged solutions for the residual loading. Full loading solutions are found for rectangular wing with control surface configurations in incompressible flow, and the results compared with other methods. The form of w(1) is calculated on a simple swept wing with control surface configuration, and is found to become irregular near the hinge line corners. Modifications to the originally chosen special loading form are suggested which should lead to convergent loading solutions for swept wings. Author

N71-29350# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
PRESSURE MEASUREMENTS ON AN HARMONICALLY OSCILLATING SWEPT WING WITH TWO CONTROL SURFACES IN INCOMPRESSIBLE FLOW
H. Forsching, H. Triebstein, and J. Wagener *In* AGARD Symp. on Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Part 2 Apr. 1971 15 p refs (See N71-29338 17-01)
Avail: NTIS

The results of an experimental study of the pressure singularities occurring along the control surface edges of a harmonically oscillating swept wing control surface system in incompressible flow are presented and discussed. The two control surfaces ranged along the whole span of the wing and could be excited so that alternatively the inner or the outer flap or even both were oscillating with different phases and amplitudes relative to each other and relative to the wing. Author

N71-29432# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
THE FLAT PLATE IN HYPERSONIC LOW-DENSITY FLOW: EXPERIMENTAL INVESTIGATIONS IN THE SHOCK FORMATION AND IN THE TRANSITION REGIME [DIE EBENE PLATTE IN HYPERSONISCHER STROEMUNG GERINGER DICHTE. EXPERIMENTELLE UNTERSUCHUNGEN IM STOSSFORMIERUNGS- UND UEBERGANGSGEBIET]
Manfred Becker (Ph.D. Thesis--Aachen Univ.) Dec. 1970 200 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-79) Avail: NTIS; ZLDI Munich: 48.80 DM

Experimental investigations of a flat plate in hypersonic low-density flow were made to clarify some aerodynamic problems between "free molecular flow and "continuum flow. Wind-tunnel measurements were performed in the flow field above the flat plate with pitot probes and hot-wire probes and at the plate surface with pressure holes and thermocouples. The results refer to the regimes of transition flow and shock formation. The formation of the downstream compression zone, the decrease of slip velocity, and jump of temperature of the leading edge are described. The accommodation of the gas particles to the condition of the plate surface was taken into account. Author (ESRO)

N71-29433# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aeroelastik.
PRESSURE MEASUREMENTS ON AN HARMONICALLY OSCILLATING SWEPT WING WITH TWO CONTROL SURFACES IN INCOMPRESSIBLE FLOW
H. Foersching, H. Triebstein, and J. Wagener Sep. 1970 33 p refs Presented at the Symp. on Unsteady Aerodyn. of Interfering Surfaces, Tonsberg, Norway, 3-4 Nov. 1970
(DLR-FB-70-47; AVA-FB-7025) Avail: NTIS; ZLDI Munich: 10.50 DM

The results of an experimental study of the pressure singularities occurring along the control surface edges of a harmonically oscillating swept wing control surface system in incompressible flow are presented and discussed. The two control surfaces ranged along the whole span of the wing and could be excited so that alternatively the inner or the outer flap or even both were oscillating with different phases and amplitudes relative to each other and relative to the wing. Author (ESRO)

N71-29572# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AERODYNAMIC PROBLEMS [PROBLEMES AERODYNAMIQUES]
Rene Ceresuela *In its* Propulsion of Hypersonic Vehicles, Pt. 1-4 1970 p 95-122 refs In FRENCH (See N71-29568 17-28
Avail: NTIS

Some aerodynamic problems related to hypersonic vehicles such as hypersonic aircraft, space shuttle, are reviewed. A cost estimate is given for development of hypersonic air-breathing rocket engines and space shuttle. ESRO

N71-29762# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
THE USE OF AERODYNAMIC LIFT FOR APPLICATION TO HIGH SPEED GROUND TRANSPORTATION Interim Report, Sep. 1969-Jun. 1970
Timothy M. Barrows, Sheila E. Widnall, and Herbert H. Richardson Jun. 1970 134 p refs
(Contract DOT-C-085-65)
(PB-197242; T70-3FRART-71-56) Avail: NTIS CSCL 01A

The problem of a wing flying in very close proximity to a solid boundary, the so-called ram wing, is reviewed and a new solution is found using the method of matched asymptotic expansions. The effect of the wing upper and lower surface

coordinates on the resulting pressure distribution is shown explicitly for the case of a two dimensional airfoil. It is shown that for very small clearance ratios a very simple expression is valid for the lift coefficient. On the basis of this simplification an analytic solution is obtained for the case of a flatplate airfoil operating above a sinusoidal ground plane, which gives the forces and moments due to ground bumps. The longitudinal dynamics of a tracked vehicle designed to utilize aerodynamic lift are then investigated. Dissert. Abstr.

N71-29774*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIAL FLOW SOLUTION FOR A STOL WING PROPULSION SYSTEM
James A. Albers and Merle C. Potter Washington Jul. 1971 35 p refs
(NASA-TN-D-6394; E-6132) Avail: NTIS CSCL 01C

The analysis considers a two-dimensional wing-fan system which consists of an airfoil with flap; the fans, which have a distributed suction at their inlet and a jet at their exit; and a jet sheet leaving the flap trailing edge. The solution provides the incompressible potential flow for any value of fan or engine mass flow coefficient, the thrust coefficient for the propulsion system exhaust, and the wing and flap angle of attack. Flow fields, pressure distributions, and lift coefficients for a particular, externally blown flap, high-lift configuration are presented. Author

N71-29778*# Massachusetts Inst. of Tech., Cambridge.
SUBSONIC STATIC CHARACTERISTICS OF SLENDER WING CONFIGURATIONS USING A MAGNETIC SUSPENSION AND BALANCE SYSTEM
Milan Vlajinac, Timothy Stephens, George Gilliam, Nicholas Pertsas, and Eugene Covert Washington NASA Jul. 1971 26 p refs
(NASA-CR-1796; TR-168) Avail: NTIS CSCL 01A

Aerodynamic forces and moments on three low-aspect-ratio wing planforms were obtained using a magnetic suspension and balance system. Comparison of the present data with both theory and experimental results obtained elsewhere is presented and shown to be in close agreement. Author

N71-29893*# Massachusetts Inst. of Tech., Cambridge.
SECTION DATA FOR THIN, HIGHLY CAMBERED AIRFOILS IN INCOMPRESSIBLE FLOW
Jerome H. Milgram Washington NASA Jul. 1971 73 p refs
(Contract NAS1-8423)
(NASA-CR-1787) Avail: NTIS CSCL 20D

The results of tests on thin, highly cambered sections are presented. The sections have sharp edges and are thin enough for the thickness effects to be negligible. There are some notable differences between the section characteristics of the thin, highly cambered sections and sections having less camber and more thickness. At the ideal angle of attack, as given by thin airfoil theory, the thin, highly cambered sections have about five times as much drag as do thicker sections of less camber. The lift of the thin, highly cambered sections at angles of incidence near ideal is significantly less than that predicted by thin airfoil theory because of the effects of flow separation. The flow separation on the pressure side is increased by a reduction of angle of attack from ideal. This results in lift slopes significantly greater than 2 pi per radian for angles of attack slightly less than the ideal angle of attack. Author

N71-30040# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Aerodynamik.
PARAMETRIC STUDIES OF ROTOR DOWNWASH CALCULATION. INFLUENCE ON FIXED WING FLOW [PARAMETERUNTERSUCHUNGEN ZUR ROTORABWINDBERECHNUNG. EINFLUSS AUF DIE UMSTROEMUNG EINES FLUEGELS]
Hans Bergmann and Jost W. Fuhr Dec. 1970 79 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-62) Avail: NTIS; ZLDI Munich: 13 DM

Parametric studies have been conducted in order to determine the influence of vortex model variations on the downwash calculations of a given helicopter rotor. Additionally, a method to calculate the lift distribution of a fixed wing located in the rotor wake is presented, neglecting fuselage disturbation. Interactions of rotor and wing are shown. As a basis for wing aerodynamics the lifting line theory is employed. A rigid rotor wake model with helical vortex lines is used. Calculation of induction is accomplished by finite and straight vortex segments and/or by semi-infinite and straight vortex lines. Author (ESRO)

N71-30283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT INVESTIGATION OF INSTALLATION EFFECTS ON A PLUG NOZZLE INSTALLED ON AN UNDERWING NACELLE
Nick E. Samanich and Roger Chamberlin Washington Jul. 1971 57 p refs
(NASA-TM-X-2295; E-5546) Avail: NTIS CSCL 01A

Several variations of plug nozzles were tested using an F-106B aircraft in the Mach range 0.6 to 1.3. These nozzles simulated the subsonic configurations of variable-geometry plug nozzles designed for Mach 2.8 operation. The nozzles were tested with a J85-GE-13 turbojet engine and the data compared to that of 0.34-scale isolated wind tunnel models. For most of the configurations tested, no significant installation effect was measured between Mach 0.8 and 0.9. There was an adverse effect at lower speeds and at Mach numbers from 1.0 to 1.2, and a favorable effect at Mach 0.95. The major differences between the isolated and installed nozzle performance resulted from changes in pressure forces on the plug surface. Author

N71-30321# Technische Hogeschool, Delft (Netherlands). Vliegtuigbouwkunde.
A UNIFIED THEORY FOR LINEARIZED SHOCK-ON-SHOCK INTERACTION PROBLEMS
N. L. Arora Dec. 1969 165 p refs
(VTH-158) Avail: NTIS

A systematic and unified theory is deduced for the non-uniform flow field produced behind a plane shock of arbitrary strength when it encounters an aerodynamic obstacle moving at supersonic speed. The obstacle has a weak attached shock and a collision between the two shocks occurs. This is known as shock-shock interaction. The obstacles considered are airfoils, antisymmetric slender bodies, and three dimensional wings. ESRO

N71-30324# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A LINEAR CONTROL OF SYSTEMS WITH RANDOM INPUT: APPLICATION TO GUST RESPONSE CONTROL [SUR LE CONTROLE LINEAIRE D'UN SYSTEME SOUMIS A UNE EXCITATION ALEATOIRE. APPLICATION A LA TENUE D'UN AVION EN ATMOSPHERE TURBULENTE]
Jacqueline Boujot (Ph.D. Thesis—Paris Univ.) 1970 68 p refs In FRENCH; ENGLISH summary
(ONERA-Publ-131) Avail: NTIS

A general optimization problem giving a standard linear expression of control is applied to complex, actual systems such as aircraft flying in turbulence. The first part is devoted to the axiomatic definition of physical linear systems from a functional point of view. With the help of optimal control theory, which gives a closed form expression in special cases, the problem is solved in a more general way in the normed space previously defined. An expansion of the solution is deduced. The analysis of gust response

properties of a structure in flight yields the formulation and the solution for the optimal gust response control of an aircraft. By applying this method it is possible to design gust response control devices whose properties and qualities are discussed from a technical point of view. Author (ESRO)

N71-30325# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

SOME EXPERIMENTAL INVESTIGATIONS ON THE MULTIPLE-BODY-PROBLEM IN SUPERSONIC FLOW [EINIGE EXPERIMENTELLE UNTERSUCHUNGEN ZUM MEHRKOERPERPROBLEM BEI UEBERSCHALLSTROEMUNG]

Friederich Keune, Hansgeorg Riedel, and Hans Emunds 1971 88 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-04) Avail: NTIS; DFVLR Porz: 28.80 DM

The most important aerodynamic coefficients of bodies having comparable volumes and which form so-called multiple-body-systems, have been determined in the 60 × 60 sq cm supersonic wind tunnel of the DFVLR for the Mach number range from 1.56 to 4.02. Of particular interest were the differences in drag arising from possible changes in the arrangement of the body system. Differences of the order of from 10% to 20% were obtained. The gain of a markedly lower drag entails no unfavorable other aerodynamic properties. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-29215# Tyco Labs., Inc., Pomona, Calif. General Nucleonics Div.

FEASIBILITY STUDY OF DESIGN AND FABRICATION OF NUCLEAR HELICOPTER LIFT INDICATOR (NUHELI) Final Report, Jul. 1968 – Jul. 1970

Donald W. Blincow Feb. 1971 138 p refs

(Contract AT(04-3)-805)

(SAN-805-1) Avail: NTIS

The development of a nucleonic instrumentation system for continuous on-board indication of helicopter lift capability and the testing of a prototype system in a realistic environment are described. The system uses X-ray backscatter from a Kr-85 source and a temperature sensor to measure ambient air density and temperature outside the vehicle and computes gross lift capability in an all-digital computer. Combining the lift capability output with helicopter start gross weight and present fuel quantity provides the pilot with a real-time readout of his lift margin at maximum rotor speed before he commits the vehicle to take off or other critical maneuver. Author (NSA)

N71-29305# National Aviation Facilities Experimental Center, Atlantic City, N.J.

PREVENTION OF AIRCRAFT LOSS OF CONTROL USING A SIMPLE HEAD-UP DISPLAY Final Report, Jul. 1969 – Dec. 1970

Gerald E. Skelton and Richard L. Sulzer Jun. 1971 24 p

(FAA-NA-71-9; FAA-RD-71-28) Avail: NTIS

To evaluate the concept of a simple head-up display (HUD) as an aid to noninstrument-rated pilots encountering reduced flight visibility conditions, two versions of such a display were flown by six pilots. The subject pilots were pretested to insure that they could not perform standard maneuvers when outside visual reference and panel attitude instruments were obscured leaving only the altimeter, airspeed indicator, gyroscopic direction indicator, gyroscopic rate-of-turn/slip-skid indicator and clock. Given either of the HUD instruments and a partial panel of basic instruments, plus a brief indoctrination in the use of the HUD, the pilots showed marked improvement in preservation of aircraft control. The opinions of expert observers suggest that, with a few hours of additional training, inexperienced pilots would be able to employ a simple HUD with a further improvement of aircraft safety when penetrating adverse weather. Author

N71-29307# IIT Research Inst., Chicago, Ill.

STUDY OF VISIBLE EXHAUST SMOKE FROM AIRCRAFT JET ENGINES Final Report

John Stockham and Howard Betz Jun. 1971 75 p refs

(Contract DOT-FA69WA-2208)

(FAA-NA-71-24; FAA-RD-71-22) Avail: NTIS

The visibility of inflight jet exhaust is compared to the SAE smoke number. A method based on photographic photometry was developed for measuring the optical density of smoke plumes. This method was related to visibility and to the smoke number through transmissometer measurements and visibility theory. A portable transmissometer, capable of operating over a wide range of optical path lengths and under varying ambient light conditions was fabricated for use on this study. The mathematical expression relating the transmission measurements to the smoke number was derived. Liminal visibility requirements of smoke trails, developed from light scattering theory, correlated with actual visual observations and the transmissometer and photometry measurements. Author

N71-29309# Little (Arthur D.), Inc., Cambridge, Mass.

AN APPROACH TO THE ESTABLISHMENT OF PRACTICAL AIR TRAFFIC CONTROL SAFETY GOALS Interim Report

S. F. Lister and G. Raisbeck May 1971 60 p refs

(Contract DOT-FA70WA-2141)

(FAA-RD-71-36) Avail: NTIS

This report shows how a knowledge of the incidence of fatal aircraft accidents in the recent past can be combined with an estimate of the overall risk in various types of human activity, which have been found socially acceptable, to produce rational, quantitative goals for the risk associated with air traffic control. Fatal accidents over an eight-year period, from 1961 to 1968 inclusive, are categorized in 36 groups based on 6 phases of flight and 6 type-cause categories. The improvement in overall air transportation safety which could be achieved by reducing or eliminating all sources of accident which are, in any way, related to air traffic control is examined. Inasmuch as the majority of fatalities cannot, by the most generous reckoning, be associated with air traffic control, the total possible improvement is not impressive. When, on the other hand, proportional reduction in risk from all causes is assumed, a set of mutually compatible risk goals for each of the 36 groups can be stated. Author

N71-29395# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Aerodynamik.

RESULTS OF THE THEORY OF ROTOR FLOW ACCORDING TO MILLER AND SCULLY [ERGEBNISSE DER THEORIE DER ROTORDURCHSTROEMUNG NACH MILLER UND SCULLY]

Jost Wilhelm Fuhr Jan. 1970 37 p refs In GERMAN; ENGLISH summary

(DLR-MITT-70-23) Avail: NTIS; ZLDI Munich: 8 DM

A brief survey on different methods of rotor downwash analyses, according to several publications dealing with this problem, is

presented. From the multitude of existing theories a simple and a rather difficult method are selected, improved, and compared.
Author (ESRO)

N71-29430# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
STUDIES RELATED TO THE OPTIMAL CONTROL AND STABILIZATION OF AIRCRAFT IN THE PRESENCE OF GUST LOAD DISTURBANCES Status Report, 15 Jun. 1970 – 31 Jan. 1971
S. K. Mitter 1971 5 p refs
(Grant AF-AFOSR-1941-70)
(AD-722072; AFOSR-71-0941) Avail: NTIS CSCL 1/3

The objective of this research is to develop a theory of controllability for parabolic and second order hyperbolic systems and for hereditary differential systems. An attempt is made to use abstract semi-group theory and spectral theory to develop the necessary results. It is proposed to apply these ideas to the stabilization problem of high speed aircrafts in the presence of severe gust load disturbances.
Author (GRA)

N71-29431# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLIGHT DYNAMICS AND CONTROL
A. M. Letov 28 Dec. 1970 326 p refs Trans. into ENGLISH of the book "Dinam. Poleta i Upr." Moscow, 1969 p 1 – 359
(AD-722280; FTD-HC-23-639-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 1/3

The report discusses methods of solving two problems of optimal control in flight vehicles: (1) the problem of programming the trajectory of the vehicles CG when the vehicle has some assigned extremal quality; and (2) the problem of synthesizing an automatic unit permitting an optimal stabilization of the vehicles motion along this flight path in accordance with an assigned criterion. Both problems are treated as falling within the scope of the calculus of variations. For solving the first problem, use is made of Pontryagins principle of a maximum, while for solving the second one, the Bellman dynamic programming procedure is used. A special chapter is devoted to continuous differential games and to solving the simplest tracking problem. The discussion is illustrated with numerous examples.
Author (GRA)

N71-29496# Technische Hogeschool, Delft (Netherlands). Vliegtuigbouwkunde
MATHEMATICAL MODEL OF EXTERNAL DISTURBANCES ACTING ON AN AIRCRAFT DURING AN ILS APPROACH AND LANDING
O. H. Gerlach and J. Schuring Mar. 1970 52 p refs
(VTH-159) Avail: NTIS

Three different types of disturbances are distinguished: the wind, atmospheric turbulence, and the noise contained in the ILS signals. The model is thought to be applicable to altitudes between ground level and 250 m. The basic material from which the model has been constructed has been compiled from available literature.
Author (ESRO)

N71-29497# Royal Aircraft Establishment, Farnborough (England).
FLIGHT TRIALS TO DISCOVER WHETHER PERIPHERAL VISION IS NEEDED FOR LANDING
B. D. Armstrong Nov. 1970 36 p refs
(RAE-TR-70205) Copyright. Avail: NTIS

The results of flight trials, at night and in low visibility, with restricted peripheral vision are described. They were undertaken to discover whether lack of peripheral vision was a major cause of poor landing performance on conventional aircraft flight simulators. The results show that landing performance in flight is almost unaffected by loss of peripheral vision, even in poor visibility.
Author (ESRO)

N71-29543# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Schwingungen.
CALCULATION OF THE UNCOUPLED VIBRATIONS OF HELICOPTER ROTOR BLADES USING THE METHOD OF TRANSFER MATRICES. EFFECTS OF AERODYNAMIC DAMPING, A BUILT-IN CONE ANGLE AND COMPARISON WITH OTHER THEORETICAL METHODS AND MEASUREMENTS [BERECHNUNG DER UNGEKOPPELTEN SCHWINGUNGEN VON HUBSCHRAUBER-ROTOR-BLAETTERN MIT HILFE DER UEBERTRAGUNGSMATRIZEN-METHODE. EINFLUSS DER AERODYNAMISCHEN DAEMPFUNG, EINES EINGEBAUTEN KONUSWINKELS UND VERGLEICH MIT ANDEREN RECHENMETHODEN UND MESSUNGEN]
Siegfried Benz Nov. 1970 96 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-63) Avail: NTIS; ZLDI Munich: 15.50 DM

The method of transfer matrices allows a relatively clear and simple solution of the problems of rotor blade vibrations, especially by use of digital computers. The uncoupled flapwise, chordwise, and torsional vibrations are dealt with. For the flapwise bending vibration, the interharmonic coupling effects owing to aerodynamic damping are taken into account. A built-in cone angle for hingeless rotors is considered for flapwise vibrations. The transfer matrix method is compared with other theoretical methods and experimental results.
Author (ESRO)

N71-29557# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USING A HELICOPTER FOR DUSTING FOREST SOURCES OF TICK-BORNE ENCEPHALITIS
V. A. Nabokov et al 20 Feb. 1970 7 p refs Transl. into ENGLISH from Med. Parazitol. i Parazitarn. Bolezi (Moscow), v. 33, no. 1, 1964 p 64 – 68
(AD-703998; FTD-HT-23-644-69) Avail: NTIS

The MU 1HX helicopter was tested for spray dusting with a 10 percent DDT dust in tick borne encephalitis foci. During the period of spraying the flight speed of the craft was kept within limits of 30 to 35 km per hour. The improved precipitation of the chemical poison permitted it to reduce its consumption rate down to 20 kg per hectare, as compared with that (50 kg per hectare) accepted for the plane AH 2. The treatment remained highly effective. In addition to considerable savings of the poisonous material the reduction of consumption rates brought with it a substantial improvement of the present economic indices. This warrants recommending the new mode of the treatment for a wide scale field application in the foci of tick borne encephalitis.
Author

N71-29562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRAULICS AND ITS APPLICATIONS ON AIRCRAFT
B. B. Nekrasov 14 Jan. 1970 402 p refs Transl. into ENGLISH of the book "Gidravlika i Yeye Primeneniye na Letatel'nykh Apparatakh" Moscow, Izd-Vo Mashinostroyeniye, 1967 p 1 – 368
(AD-701974; FTD-HT-23-242-69) Avail: NTIS HC $6.00/MF $0.95

The application of hydraulic systems to the operation of aircraft is discussed. Subjects presented are: (1) fundamentals of hydrostatics, (2) fundamental equations of hydraulics, (3) relative and nonsteady motion of fluid in pipes, (4) hydraulic drives and hydraulic transmissions, (5) design of hydraulic equipment for aircraft use, and (6) characteristics of centrifugal pumps.
P.N.F.

N71-29635# Federal Aviation Administration, Oklahoma City, Okla. National Flight Inspection Div.
EVALUATION OF IFR DEPARTURE PROCEDURE, ALBUQUERQUE, N. M., RUNWAY 08 Final Report

Norman C. Heidger, Harold R. Richards, and Frank Parr May 1971 28 p
(FAA-FS-600-2) Avail: NTIS

A flight simulator study was made of an IFR departure procedure from a runway. Hot day temperature and calm surface winds were used for initial tests. Normal values were used to simulate actual ABQ conditions for easterly wind flows. 64 departures were made by 5 qualified pilots in the Boeing 720 flight simulator. A statistical analysis was made of recorded flight tracks to determine the average maximum distances and to calculate the 95 and 99 percent confidence limits of these averages. Left and right turns were flown, with specified turning heights of 400 and 700 feet above ground level. Statistically derived 99% upper limits of the average maximum flight track distances were obtained. Author

N71-29657# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALYTICAL METHODS FOR PROJECTED CONSTRUCTION OF WINGS

I. S. Golubev 28 Dec. 1970 313 p refs Transl. into ENGLISH of the book "Analit. Metody Proektir. Konstruktsii Krylev" USSR, 1970 p 1-288
(AD-722303; FTD-HC-23-592-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 1/3

This book contains an investigation of two interrelated problems: finding optimal material distribution in the wing structure and selecting the structural-technological solutions. The optimal law of material distribution is found by the methods of nonlinear programming. On the basis of replacing a variable function by a set of discrete parameters, the calculational relations (criterial functions, conditions, restrictions) corresponding to the numerical and analytical methods of solving the design problem and various calculational schemes for the wing are obtained. First, the simplest cases are presented - single load system, absence of heating, isotropic structure, etc. On the basis of these cases, general relations are derived permitting consideration of the effect of aerodynamic heating, the load spectrum, and pliability of the wing fastening. The transition from the calculational scheme to the structural scheme and selection of the optimal structural-technological version of the wing are carried out on the basis of analyzing the additional weight, sources of which are the stability of the structural elements, reliability, technological factors and operating conditions. Author (GRA)

N71-29680# Technische Univ., Berlin (West Germany). Fakultaet fuer Maschinenwesen.

CONTRIBUTION TO THE THEORETICAL TREATMENT OF THE HUB EFFECT IN PROPELLER DESIGN [BEITRAG ZUR THEORETISCHEN BEHANDLUNG DES NABENEINFLUSSES BEIM PROPELLERENTWURF]

Carsten Oestergaard (Ph.D. Thesis) 1969 77 p refs In GERMAN
Avail: NTIS

The displacement effect of the propeller hub in the potential wake flow produces pronounced changes in the flow field of the propeller blade. Computer calculations for effective propeller design, using the lift line model to provide optimal boundary conditions for the circulation distribution around the hub, showed that the theory is not sufficient to describe all hydrodynamic processes around a propeller. Transl. by G.G.

N71-29708# Air Force Academy, Colo.

AN APPROACH GUIDANCE SYSTEM FOR SIDE-FIRING TACTICAL AIRCRAFT

Bradford W. Parkinson, Edward J. Bauman, and Jack C. Henry Oct. 1970 45 p
(AD-722412; USAFA-TR-70-4) Avail: NTIS CSCL 1/2

The present approach guidance scheme is one of controlling the aircrafts velocity vector; however, this scheme has two major disadvantages: its a difficult flying task for the pilot, and when the aircraft arrives tangent to the circular path, a violent maneuver is usually required to achieve the proper bank angle to stay on the desired circular path. An improved method for controlling the side firing AC-130 and AC-119 into circular attack geometry eliminates these disadvantages. Furthermore, with this improved system the bank angle rates never exceed 3 or 4 degrees per second. This control scheme was simulated on the analog computer and the results are presented graphically. The simulation showed that the bank angle, command-control scheme is effective for distances out to five circular orbit radii from the target and is effective for all aircraft headings (with one exception which is discussed in a stability study in the appendix). The initial test flight showed that the bank angle control scheme behaved very well, and its overall performance was near that predicted. Relatively minor modifications can incorporate this control scheme into existing analog computers on board the aircraft. Author (GRA)

N71-29777# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

NOISE EXPOSURE FORECAST CONTOURS FOR EXPECTED 1985 AND 1990 OPERATIONS AT SEVEN US AIRPORTS

Jan. 1971 93 p refs
(AD-722365; BBN-2076) Avail: NTIS CSCL 20/1

The report summarizes a study of the probable impact of future supersonic transport (SST) aircraft operations on the noise environment around seven airports in the United States. The noise environment is depicted in terms of Noise Exposure Forecast (NEF) contours of NEF 30 and 40 values for projected 1985 and 1990 operations at the following seven airports: Anchorage International Airport (ANC); Logan International Airport, Boston (BOS); Honolulu International Airport (HNL); John F. Kennedy International Airport, New York (JFK); Los Angeles International Airport (LAX); Seattle-Tacoma International Airport (SEA); San Francisco International Airport (SFO). Sets of noise contours are given for each airport for the two projections. Author (GRA)

N71-29796# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

RELIABILITY Final Report

10 Mar. 1971 18 p
(AD-722721; MTP-7-3-508) Avail: NTIS CSCL 14/4

The procedure defines methodology for evaluating the relability of aircraft and related subsystems and allied equipment. Author (GRA)

N71-29797# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

INTERNAL/EXTERNAL LIGHTING Final Report

12 Mar. 1971 9 p refs
(AD-723034; MTP-7-3-527) Avail: NTIS CSCL 1/3

Procedures are described for determining the functional suitability of internal/external lighting systems for U.S. Army aircraft. Author (GRA)

N71-29914# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: MISSISSIPPI VALLEY AIRWAYS, INCORPORATED DEHAVILLAND DHC-6, N9565M, LA CROSSE, WISCONSIN, 9 NOVEMBER 1970

5 May 1971 13 p
(NTSB-AAR-71-10) Avail: NTIS

A Mississippi Valley Airways, Inc., DeHavilland DHC-6, N9565M, crashed at La Crosse, Wisconsin, on November 9, 1970, at approximately 1608 central standard time while executing a nonprecision instrument approach in instrument flight conditions. The aircraft struck trees approximately 4,000 feet from the threshold of runway 13 on approach centerline. The aircraft was destroyed by impact. The captain, first officer, and three of the four passengers sustained serious injuries. There was no post-crash fire. The National

Transportation Safety Board determined that the probable cause of this accident was that for unknown reasons, the captain failed to maintain altitude at minimum descent altitude and allowed the aircraft to descend below the height of trees while executing a nonprecision instrument approach in instrument flight conditions. Author

N71-30029# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: OVERSEAS NATIONAL AIRWAYS, INCORPORATED, DOUGLAS DC-9, N935F OPERATING AS ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ FLIGHT 980 NEAR SAINT CROIX, VIRGIN ISLANDS, 2 MAY 1970

31 Mar. 1970 33 p

(NTSB-AAR-71-8; SA-420) Avail: NTIS

Overseas National Airways Flight 980 (ALM), was ditched near St. Croix. Forty persons, including 35 passengers and five crewmembers survived. Twenty-three persons, including two infants and the stewardess, did not survive. The aircraft sank in 5,000 feet of water and was not recovered. The flight departed Kennedy International Airport, N.Y., nonstop for St. Maarten, Netherlands Antilles. After an ADF and three circling approaches in poor weather, during which a landing could not be made, the flight departed for St. Croix. Enroute to St. Croix in a low-fuel state, the aircraft was descended to the water in anticipation of a ditching. When fuel exhaustion was reached, the engines flamed out and the aircraft was ditched. Author

N71-30039# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Aerodynamik.

CALCULATION OF THE INDUCED VELOCITY DISTRIBUTION OF A ROTOR IN STATIONARY FORWARD FLIGHT [BERECHNUNG DER INDUZIERTEN GESCHWINDIGKEITSVERTEILUNG EINES ROTORS IM STATIONAEREN VORWAERTSFLUG]

Jost Wilhelm Fuhr and Alfred Kussmann Mar. 1970 53 p refs In GERMAN; ENGLISH summary

(DLR-MITT-70-22) Avail: NTIS; ZLDI Munich: 10.50 DM

A simplified method of rotor downwash calculation is described. The rotor wake system is substituted by discrete vortex lines according to the lifting line theory. A separation in a near wake system consisting of semi-infinite vortex lines and a far wake system with fore and aft infinite vortex lines is introduced for calculation. The digital computer program is described and analytical results are presented. Author (ESRO)

N71-30128# Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).

BIRD HAZARDS TO AIRCRAFT: A LITERATURE SURVEY. VOLUME 2: OCTOBER 1967–JANUARY 1971

H. Crop and G. A. J. Kerstens, comps. Jan. 1971 16 p refs

(TDCK-56961) Avail: NTIS

The literature survey covers the period October 1967 to January 1971, and contains 22 abstracts. Author

N71-30173# Systems Technology, Inc., Hawthorne, Calif.

INVESTIGATION OF MEASURING SYSTEM REQUIREMENTS FOR INSTRUMENT LOW VISIBILITY APPROACH Final Report, Jul. 1969–Jun. 1970

Dunstan Graham, Warren F. Clement, and Lee Gregor Hofmann Wright-Patterson AFB, Ohio AFFDL Feb. 1971 220 p refs

(Contract F33615-69-C-1904)

(AD-722773; AFFDL-TR-70-102) Avail: NTIS CSCL 1/2

A practical method of determining measuring system requirements for instrument low visibility approach is presented. The method is made to depend on system analysis of the airplane, its control system, and the guidance system, as well as on atmospheric turbulence inputs and radio guidance system fluctuation noise. Requirements on the system are set in terms of a low value of the accident exposure multiplier which is related to the probability of a missed approach in the assumed enviornment. The application of the method is demonstrated in connection with two examples: manual-flight director approach in the A-7D attack airplane, and automatically coupled approach with an advanced windproof flight control system in the DC-8 transport aircraft. The results, including particularly the implied requirements on scan rate for a scanning beam instrument low visibility approach system, demonstrate the interconnections between scanning rate, flight control, and overall system performance. Author (GRA)

N71-30174# Center for Naval Analyses, Arlington, Va. Inst. of Naval Studies.

NAVAL AIRSPACE USAGE: A SURVEY OF NAVY AND MARINE CORPS FLIGHT ACTIVITY

Lawrence E. Brumbach Feb. 1971 132 p refs Its Res. Contrib. 160

(Contract N00014-68-A-0091)

(AD-722698) Avail: NTIS CSCL 1/2

A comprehensive data base is presented with detailed information on the manner in which airspace is used by Navy and Marine Corps operational squadrons. It is based on a nationwide survey conducted in February and March, 1970. The conduct of the survey is described, and examples of the application of selected data are given. With emphasis on the interaction between operational flight training and the National Airspace System, statistical data is assembled on the use of airways, the Positive Control Area, Warning Areas, Restricted Areas, and related aspects of Naval flight activity. This research contribution is one of several documents producted in support of Project Blue Air: An Analysis of Naval Airspace Usage. A complete list of these documents is given in the project report, INS Study No. 34. Author (GRA)

N71-30241*# Clemson Univ., S.C.

MINIMUM VARIANCE ESTIMATES OF SIGNAL DERIVATIVES: A PROBLEM IN INSTRUMENT LANDING SYSTEMS

J. C. Martin Dec. 1970 17 p refs

(Grant NGR-41-001-024)

(NASA-CR-111928) Avail: NTIS CSCL 01E

As in the case for the rate of descent of an aircraft, frequently the derivative of a state cannot be observed with sufficient accuracy. The state itself can however; but, as with the radar altimeter, the signal is too noisy for differentiation. The approach presented uses the form of the Kalman filter as an observer for the derivatives of the observed signals or states. The gain matrix for the filter is derived to minimize the variance of the estimate of the derivative of the state, instead of the state itself. The derived gain matrix and the covariance of the (derivative) estimation error are related to those of the Kalman filter through the system's dynamics. A quantitative evaluation of this method's improvement over taking the derivative of the otimum filter of the state and/or augmenting the state vector, is included. The improvement over the former is shown to increase linearly with the covariance of the state's estimation error. Over augmenting the state vector, the improvement uses the lower order, observable states more directly through the systems dynamics. Author

N71-30282*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LOW SPEED WIND TUNNEL INVESTIGATION OF A SEMISPAN STOL JET TRANSPORT WING WITH DEFLECTED THRUST AND BLOWING BOUNDARY LAYER CONTROL

Robert L. Henderson Washington Jul. 1971 87 p refs

(NASA-TN-D-6256; L-7543) Avail: NTIS CSCL 01A

An investigation of the static longitudinal aerodynamic characteristics of a semispan swept wing with an aspect ratio of 3.92 and having deflected thrust and blowing boundary-layer control was performed mainly in a low-speed tunnel with a 3.7-m (12-ft) octagonal test section at the Langley Research Center. Thrust was provided by two pod-mounted ducted fans equipped with 60 degree exhaust deflection vanes, and boundary-layer control was provided by air blowing through a slot over a full-span plain trailing-edge flap. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-29364# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Bauweisen und Konstruktionsforschung.

FEASIBILITY STUDY OF A ROLL UP SOLAR ARRAY WITH FOLDABLE TUBES AS SUPPORT STRUCTURES [DURCHFUEHRBARKEITSSTUDIE EINES STAUBAREN SOLARZELLENAUSLEGERS MIT FALTROHREN ALS TRAEGERSTRUKTUR]

Kuno Stellbrink Feb. 1971 62 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-11) Avail: NTIS; DFVLR Porz: 18 DM

The feasibility study of a 3 kW roll up solar array with storable support structures is dealt with. These structures consist of "Faltrohre" (foldable tubes) cylindrical tubes with closed cross section. They can be pressed flat and rolled up. Released, "Faltrohre" uncoil themselves because of the deformation they suffer by being rolled up. Author (ESRO)

N71-29498# AEG-Telefunken, Ulm (West Germany).

A FURTHER STUDY ON THE DEVELOPMENT OF IMPROVED INTERCONNECTION TECHNIQUES FOR SILICON SOLAR-CELL ARRAYS Quarterly Report, 1 May – 31 Jul. 1969

H. Duerre, J. Gehrke, and H. Buhs Paris ESRO Jan. 1970 62 p refs

(Contract ESTEC-705/69-AA)

(ESRO-CR-13; QR-1) Avail: NTIS

A welding process producing space-rated interconnections between silicon solar cells is optimized. The selection of interconnector material is dealt with. The properties expected from an interconnector material are reviewed and compared with the characteristics of various pure metals and alloys. Four materials are considered for a final choice: Ag, Mo, VACON and Nb. The surface coating required for the last three materials is discussed at length. It is shown that good adherence is difficult to obtain in the case of Nb. A further element of choice is discussed; the pull strength obtained after optimization of welding parameters. The experiments clearly indicate the superiority of silver-coated molybdenum. The pull strength obtained with this material on 300 micron solar cell dummies attains 4.5 kp (kg force) at the back contact and 3.5 kp at the front connection. Author (ESRO)

N71-29694 Illinois Inst. of Tech., Chicago.

TRANSPORT PROCESSES IN FUEL CELLS

Robert Walter Lyczkowski (Ph.D. Thesis) 1970 286 p

Avail: Univ. Microfilms Order No. 70-14160

A mode of operation and a design technique was developed which permits the attainment of continuous purging of impurities directly from gas compartments of a fuel cell with the realization of minimum reactant loss. A way was found to eliminate the complex periodic purge valves and attendant electronics. A two dimension model was developed which enables concentration and current distributions in dead-ended fuel cell compartments to be calculated using a convective diffusion equation. Velocity components were obtained by use of Darcy's Law and a solution of Poisson's equation for pressure coupled to the species equation. Both the one and two dimensional models incorporate a current density function obtained from experimental data. The perturbation pressure equation was solved by the use of Green's functions and the species equation was solved by finite differences. Two dimensional results for the average current as a function of time tend to agree more closely than the one dimensional results with published experimental observations. Dissert. Abstr.

N71-29786# California Univ., Los Angeles. School of Engineering and Applied Science.

DESIGN STUDIES FOR HIGH RATE, HIGH ENERGY, NONAQUEOUS ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Final Report, 1 Aug. 1969 – 31 Jul. 1970

Douglas N. Bennion, John S. Dunning, and William H. Tiedemann Dec. 1970 145 p refs

(Contracts N00123-70-C-0188; N123(62738)-57439A)

(AD-722384; UCLA-ENG-7078; NWCCL-TM-44-31) Avail: NTIS CSCL 10/3

Studies have been made of the electrochemical reaction mechanisms, solution properties, and theoretical design criteria for electrochemical energy conversion devices with potentially high energy density. The reduction of meta-dinitrobenzene (m-DNB) in liquid ammonia and in dimethyl sulfoxide (DMSO) solutions has been studied. The results show strong dependence of the reduction mechanism on the proton-donating ability of the electrolyte, with an eight electron transfer possible in ammonium nitrate-liquid ammonia solutions. A mathematical model for porous electrodes using sparingly soluble reactants has been developed. The results of numerical calculations based on this model show that mass transfer limiting currents are possible in nonaqueous batteries using such electrodes. In addition, studies of electrolyte solution properties in liquid ammonia, DMSO, and dimethyl sulfite (DMSU) have been carried out. A new, high voltage, high power density cell has been discovered. Results of cell tests, though preliminary, indicate that the actual packaged energy density of the system may be low (l watt-hr/lb). The electrodes are a lithium negative and a lamellar compound of graphite positive. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-29216*# Technology, Inc., San Antonio, Tex. Life Sciences Div.

STUDY OF PHYSIOLOGICAL TOLERANCE TO CENTRIFUGATION Final Report

D. M. Miller, B. Ward, J. V. Benedict, and J. A. Nickel 15 Jun. 1971 20 p refs

(Contract NAS9-11314)

(NASA-CR-115068) Avail: NTIS CSCL 06S

A centrifuge bed rest study designed to determine the physiological effects of acceleration, following simulated weightlessness, was performed. Procedures involved in the experimental design, maintenance of the subjects, instrumentation scheduling, and data coordination and reduction are outlined. Preliminary results show a general decrease in tolerance to +G sub z acceleration loads following seven days of bed rest. Author

N71-29228*# Texas A&M Univ., College Station.
BACTERIOLOGY OF SELECT AQUATIC HOSTS UTILIZED IN LUNAR SAMPLE EXPOSURE STUDIES Final Report
D. H. Lewis 20 May 1971 5 p refs
(Contract NAS9-10830)
(NASA-CR-115064) Avail: NTIS CSCL 06M

The screening of Apollo mission aquatic test animals for pathogenic bacteria is cited. Immunofluorescent techniques developed for processing specimens in confined environments are reported with processing techniques for large numbers of bacterial isolates utilizing limited space and minimal amounts of test media. Test results are presented in tabular form. J.M.

N71-29249# California Univ., Berkeley. Lawrence Radiation Lab.
THE USE OF THE EXISTING CHARGED HEAVY PARTICLE ACCELERATORS AND THE POSSIBILITIES OF CREATING NEW DOMESTIC ONES FOR RADIATION THERAPY
V. P. Dzhelepov et al Sep. 1970 36 p refs Transl. into ENGLISH of Russian report JINR-P9-4560 Presented at the Symp. on Probl. in the Develop. of Radiation Therapy Tech. in Oncology, Moscow, Apr. 1969
(UCRL-Trans-1422; Conf-690448-1; JINR-P9-4560) Avail: NTIS

Therapy of malignant tumors by means of heavy particles of high energies is a progressive principle in medicine promising success. The accelerated development of ion-corpuscular therapy and its use with electron–photon therapy is an urgent problem. Existing proton accelerators opened a front for clinical and research work. The construction of a series of special medical accelerators and the necessary equipment for a number of oncological institutes is not connected with any serious technological difficulties and requires no excessive capital expenditures. Author (NSA)

N71-29257# Joint Publications Research Service, Washington, D.C.
MAIN DIRECTION OF MATHEMATICAL MODELING IN MICROBIOLOGY
A. M. Bezborodov et al 24 Jun. 1971 9 p ref Transl. into ENGLISH from Prikl. Biokhim. Mikrobiol. (Moscow), v. 7, no. 3, 1971 p 251–258 Presented at the All-Union Microbiol. Soc., Moscow, Feb. 1970
(JPRS-53452) Avail: NTIS

The general problems involved in mathematical modeling of microbiological processes and different aspects of resolving some of the most pressing problems at this stage of development of research and production in the field of microbiological synthesis are discussed. Special attention is given to methodological aspects of modeling, the problem of creating a model of the cell of a microorganism and a model of a population of microbial cells; to the control of biosynthetic processes and influence of different exogenous factors on microbiological synthesis; to optimization conditions and methods. Author

N71-29325*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE STATION RF HAZARDS
R. A. Inman *In its* Instrumentation and Commun. Res. at MSFC, Vol. 4 May 1971 p 51–55 refs (See N71-29319 17-14)
Avail: NTIS CSCL 06R

Harmful biological effects that may be caused by exposure to microwave radiation are discussed. Typical values of radio frequency (RF) power density in the vicinity of space station antennas are calculated and compared to existing microwave exposure standards. It is shown that the currently accepted limit for exposure to rf radiation can be exceeded easily in the near field of high gain antennas on the space station. Author

N71-29358# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
SOME CONSIDERATIONS IN ESTABLISHING PURITY STANDARDS FOR CARBON MONOXIDE IN THE BREATHING GAS OF DIVERS Interim Report
Joseph D. Bloom 12 Jun. 1970 16 p refs
(AD-721680; NAVMED-M4306.02-2110B-1; SMRL-629) Avail: NTIS CSCL 6/11

The literature on carbon monoxide toxicity is voluminous and growing. In environments of one atmosphere the short-term effects of various breathing gas mixtures and blood levels are fairly well defined as a function of exposure time. There is, however, incomplete data on which to base extrapolation of these limits to the hyperbaric environments or to evaluate the existence of long-term effects. The paper briefly reviews the rationale for the currently established standards, and discusses some of the newer considerations related to hyperbaric exposure. Author (GRA)

N71-29359# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
MAXIMUM PERMISSIBLE LIMITS OF CONTAMINENTS FOR DIVERS BREATHING GAS: AN OVERVIEW Interim Report
Joseph D. Bloom 12 Jun. 1970 11 p
(AD-721681; NAVMED-M4306.02-2110B-2; SMRL-631) Avail: NTIS CSCL 6/11

Navy biomedical research strives to establish limits of contamination of breathing gas tolerable to Naval personnel in operational settings. Customary steps in the determination of these limits include exposure of laboratory animals to the contaminant followed by observation of patterns of morbidity and mortality in these animals. This data is then extrapolated to humans under exposure conditions that may or may not be similar to those of the laboratory experiment. In addition to animal-human and time frame extrapolations, establishment of limits applicable to the hyperbaric environments must also consider the relevance of partial pressure increase and the possible synergism or antagonism among multiple contaminants. This paper elaborates on these steps in the chain of biomedical investigation of contaminant toxicity and the pertinent pitfalls associated with them. Author (GRA)

N71-29417# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TOXICOLOGY OF INHALED PLUTONIUM: EXPERIMENTAL ANIMAL STUDIES
W. J. Bair 1970 43 p refs Presented at the Seminar on Radiation Protect. Probl. Relating to Transuranium Elem., Karlsruhe, West Ger., 21–25 Sep. 1970; sponsored by Euratom
(Contract AT(45-1)-1830)
(BNWL-SA-3469; Conf-700930-2) Avail: NTIS

Results are reported from studies on dogs of the up-take and subsequent tissue disposition of several inhaled plutonium compounds including (Pu-239)O2, (Pu-239)(NO3)4, and (Pu-239)F4 and several types of (Pu-239)O2 and (Pu-239)O2 aerosols of different particle size distributions. Plutonium dioxide calcined at 1000 C showed maximum retention, while Pu(NO3)4 was cleared most rapidly from the lung. Of the PuO2 aerosols, those composed of the smallest sized particles showed the greatest rate of clearance from the lung. Except for Pu(NO3)4, which translocated principally to bone and liver, the tracheobronchial lymph nodes accumulated the major fraction of plutonium translocated from the lung. Data from nearly 100 dogs, some followed for as long as 9 years, were used to develop a mathematical model for inhaled PuO2 in dogs. The half-time for pulmonary retention of alveolar deposited plutonium was about 1000 days. Excretion was principally via the feces. Lymphopenia was the most consistent clinical observation in animals with lung burdens. Long-term effects include pulmonary neoplasia. Author (NSA)

N71-29444# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
EFFECT OF A SUBMARINE PATROL ON VISUAL PROCESSES Interim Report

S. M. Luria, Harris Newmark, III, and Hugh Beatty 14 Sep. 1970 16 p refs
(AD-721683; NAVMED-M4305.08-3001D-6; SMRL-641) Avail: NTIS CSCL 6/16

Two separate studies were undertaken to see if any measurable deterioration in basic visual processes occurred during one submarine patrol. There was no significant decline in acuity, stereoacuity, or refractive power, but there was a significant increase in near esophoria. This was consistent with long term effects reported previously. The results are discussed and suggestions made for future research. Author (GRA)

N71-29540# Joint Publications Research Service, Washington, D.C.

EXPERIMENT ON COMPUTER PROGRAMMING OF INFLUENZA EPIDEMIC

L. A. Rvachev *In its* Cybernetics and Regulation Theory 18 Jun. 1971 p 18–20 refs (See N71-29536 17-10)
Avail: NTIS

The simulation of an influenza epidemic spreading over a vast territory from a single city is described. The formulas are based on the population of the initial city, the number of infected persons, the number of nonimmunized persons, the maximum duration of illness, the probability of remaining ill for a given time after the onset of the disease, the average frequency of intracity transmission of the infection, and the number of persons that moved from the initial city to another city per unit of time. Data was fed to the computer from the actual epidemic beginning in Leningrad in early January 1965 and spreading to Moscow during the end of January and February. The simulation was extended to 23 other cities for which statistical data are available. The agreement between the sets of data indicate that epidemic growth can be simulated. N.E.N.

N71-29560# Human Engineering Labs., Aberdeen Proving Ground, Md.

SCHEMA LEARNING AND UTILIZATION AS A FUNCTION OF TASK AND STIMULUS VARIABLES

Chris T. Bersted, Bill R. Brown, and Selby H. Evans Dec. 1969 27 p refs
(AD-701184; TM-22-69) Avail: NTIS

Two experiments were conducted to evaluate the effects of constraint redundancy shifts, length of rest interval and duration of intertask interval upon the acquisition and transfer of schematic concepts. The first study indicated that increasing the magnitude of stimulus redundancy in a simple discrimination task facilitates schematic concept formation (SCF), but that the redundancy variable interacts with length of the rest interval administered prior to the redundancy shift. Transfer of SCF from a discrimination task to a modified reproduction task following a variable intertask interval was demonstrated in the second experiment; this demonstration, however, required the use of an extremely sensitive dependent measure. The results from the two studies complement each other in that they indicate hypothesis shifting by Ss, rather than fatigue or boredom, to be the primary basis for both the variable performance and the small positive transfer in schematic concept formation tasks. Author

N71-29561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN ELECTRORGENTGENOGRAPHIC METHOD OF INVESTIGATION IN DIAGNOSING DISEASES OF THE CARDIOVASCULAR SYSTEM AND RESPIRATORY ORGANS

N. R. Paleyev 25 Sep. 1969 13 p refs Transl. into ENGLISH from Sov. Med. (USSR), no. 11, 1968 p 22–26
(AD-700296; FTD-MT-24-219-69) Avail: NTIS

The first experiment in applying the electroroentgenographic method of investigation to diseases of the respiratory organs and cardiovascular system have indicated its diagnostic value. The method possesses important technical merits and is very economical. It is expedient to use this method extensively in hospital and polyclinical practice. Electroroentgenography can be used as a method of roentgenographic control during surgical operations. Author

N71-29636# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

TOLERANCES OF THE HUMAN BRAIN TO CONCUSSION

John J. Swearingen Mar. 1971 7 p refs
(FAA-AM-71-13) Avail: NTIS

The pertinent literature and additional evidence indicating that the human brain may be able to tolerate head impact forces in the range of 300 to 400 g's without evidence of concussion or other detectable neurologic sequelae, is reviewed. Provisions to prevent deformation of the cranium are stipulated. Author

N71-29637# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

EFFECTS OF CONFLICTING AUDITORY STIMULI ON COLOR-WORD INTERFERENCE AND AROUSAL

Richard I. Thackray and Karen N. Jones Mar. 1971 11 p refs
(FAA-AM-71-7) Avail: NTIS

Male subjects were tested to determine whether the interference effect produced by the Stroop color word test might be enhanced through the use of simultaneously presented, conflicting auditory stimuli. When instructed to respond only to the hue of visually presented color words printed in incongruent inks, neither task-related (conflicting color names) nor task-unrelated (random numbers) auditory stimuli resulted in any increase in the Stroop interference effect, and there were no indications of an increase in autonomic indices of arousal. It was concluded that the use of simultaneous auditory stimuli contribute nothing additional to the basic Stroop test in terms of either task interference or level of arousal. Author

N71-29638# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

EFFECTS OF LOW-GRADE HYPOXIA ON PERFORMANCE IN A VIGILANCE SITUATION

Vincent Fiorica, Mary Jo Burr, and Russell Moses Mar. 1971 12 p refs
(FAA-AM-71-11) Avail: NTIS

Forty male subjects participated in a study to examine the relationship between low grade hypoxia and vigilance performance. At an altitude equivalent of 11,500 feet in a low pressure chamber, subjects without supplemental oxygen did not respond differently from well oxygenated subjects at the same altitude with respect to such physiologic measures as heart rate, respiratory frequency, internal body temperature, or plasma concentrations of glucose or lactate. Nor were these measures significantly different between groups studied at altitude and ground level controls. The only evidence of hypoxia observed in the altitude/room air group was a decrease in blood oxygen saturation measured with an earpiece oximeter. Vigilance performance deteriorated with time in all groups. No significant differences, however, could be detected between the hypoxic group and the well oxygenated groups. Author

N71-29639# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

ASSESSMENT OF A STRESS RESPONSE SET IN THE COMPOSITE MOOD ADJECTIVE CHECK LIST

Roger C. Smith Apr. 1971 22 p refs
(FAA-AM-71-14) Avail: NTIS

The effects of response sets to emphasize the appearance of stress in Composite Mood Adjective Check List (CMACL) records was investigated. Responses of 79 subjects asked to simulate

stress, and 80 subjects asked to simulate stress in a subtle manner, were compared to CMACL responses obtained under normal conditions. A six word index was developed which was successful in identifying 95 per cent of the simulated profiles, while misclassifying only 12 per cent of the non-simulated, or authentic, profiles. The application of the index to clinical and research settings in aviation was discussed. Author

N71-29868# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

TOXICOLOGY OF INHALED PLUTONIUM

W. J. Bair *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 697–720 refs (See N71-29851 17-13)
(Contract AT(45-1)-1830)
Avail: NTIS HC$6.00/MF$0.95

In a series of experiments over 14 years, several plutonium compounds (Pu-238O2, Pu-239O2, Pu-239F4, and Pu-239(NO3)4) were administered to beagle dogs by inhalation to define the disposition of plutonium in the body and the resultant biological responses at the cellular and organ levels. All compounds showed a relatively long residence time in the lung. Plutonium translocated from the lung to other tissues accumulated principally in the tracheobronchial lymph nodes and to a lesser extent in liver, abdominal lymph nodes, and bone. After several years, plutonium in the tracheobronchial lymph nodes of dogs comprised about 40% of the total PuO2 initially deposited in the alveolar lung. The biological effects observed in these studies included lymphopenia, cellular changes in lung and tracheobronchial lymph nodes, respiratory insufficiency, and pulmonary neoplasia, depending upon amount of plutonium inhaled. Author (NSA)

N71-29869# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

A DYNAMIC SIMULATION OF THE RETENTION AND TRANSLOCATION OF INHALED PLUTONIUM OXIDE IN BEAGLE DOGS

Bruce O. Stuart, Paul J. Dionne, and William J. Bair *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 721–737 refs (See N71-29851 17-13)
(Contract AT(45-1)-1830)
Avail: NTIS HC$6.00/MF$0.95

A dynamic simulation model for the biological disposition of inhaled plutonium oxide was developed using hybrid computer techniques. Tissue, blood, and excretion data collected from more than 60 beagle dogs up to 8.5 years after single inhalation exposures to Pu-239O2 were incorporated into a program that predicts the long-term retention and translocation of inhaled insoluble plutonium. The dynamic simulation fitted to the accumulated data shows 10% of the plutonium initially deposited in the pulmonary lung remains at 12 years after exposure; the majority of this material follows a 4-year retention half-time. At 15 to 20 years after exposure the tracheobronchial lymph nodes, liver, and skeleton burdens plateau at 55%, 16%, and 6% of the plutonium deposited in the pulmonary lung. Author (NSA)

N71-29900*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

STUDY OF THE EFFECTS OF THE DOPPLER SHIFT ON PERCEIVED NOISINESS

Karl S. Pearsons, Ricarda Bennett, and Sanford Fidell Washington NASA Jul. 1971 53 p refs
(Contract NAS1-9427)
(NASA-CR-1779) Avail: NTIS CSCL 05E

Subjective judgments of the effects of Doppler shifts on perceived noisiness were made by 20 college students in an anechoic chamber. The stimuli heard in the tests included both recorded and simulated aircraft flyovers. Computer controlled generation of the simulated flyovers permitted independent variation of the source frequency, apparent altitude, amplitude, and Doppler patterns. Data collection was governed by a computer based adaptive technique known as parameter estimation by sequential testing (PEST). The major finding was that effective perceived noise level (EPNL) is a fairly accurate predictor of noisiness of flyovers containing Doppler shifts; except perhaps at altitudes of less than 500 feet, for which flyovers it underestimates apparent noisiness. Compensation for the rise time of the stimuli (an onset correction) did not improve the accuracy of prediction provided by effective perceived noise level. The frequency of pure tone components in the stimuli did not influence the subjects' judgments. Author

N71-30150# Joint Publications Research Service, Washington, D.C.

EFFECT OF PROLONGED EXPOSURE TO A HYPEROXIC GASEOUS MIXTURE ON THE HUMAN RESPIRATORY SYSTEM

N. A. Agadzhanyan et al 10 Jun. 1971 9 p refs Transl. into ENGLISH from Patol. Fiziol. i Eksperim. Terapiya (Moscow), no. 2, 1969 p 46–49
(JPRS-53332) Avail: NTIS

Results are presented for an experiment in which two human subjects remained ten days in a specially equipped pressure chamber filled with a gaseous mixture containing 50 to 56% oxygen under ground conditions (pO2 = 400mm Hg). The hyperoxic atmosphere produced a slight increase in the minute ventilation, O2 utilization, and partial pressure of oxygen in alveolar air without significantly affecting the CO diffusion capacity of the lungs. This demonstration of man's ability to remain for ten days under such conditions can be used as the physiological basis for determining oxygen conditions in inhabited airtight cabins, marine sports, and clinical medicine. Author

N71-30175*# National Aeronautics and Space Administration, Washington, D.C.

CORN BLIGHT WATCH EXPERIMENT

20 Jul. 1971 45 p
(NASA-News-Release-71-129) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 02C

The 1971 NASA, USDA, and Corn Belt States ground and air study of southern corn leaf blight is summarized. The surveillance aircraft and equipment are described as well as the ground based equipment. Operational and data reduction procedures are included for Illinois, Indiana, Iowa, Minnesota, Missouri, Nebraska, and Ohio. J.M.

N71-30188# Kansas Univ., Lawrence. Dept. of Psychology.

THE DIFFERENTIAL EFFECTS OF FINE AND GROSS BODILY MOVEMENTS UPON VISUAL ADAPTATION TO PRISM PRODUCED TILT

Gayle Rae Wheeler (Ph.D. Thesis) Oct. 1970 171 p refs
Avail: NTIS

The degree to which various types of movement promote visual adaptation to optical tilt was investigated. A comparison was made between walking in a hallway during prism exposure and visually guided arm movement during exposure. In order to determine how much visual adaptation was due to viewing two widely different environments, a comparison was made of two viewing conditions in which only head and eye movements occurred. Optical rearrangement in both studies was produced by prisms that tilted the field, mounted monocularly on safety goggles. Author

N71-30290*# Research Triangle Inst., Durham, N.C.

NASA APPLICATION TEAM PROGRAM: APPLICATIONS OF AEROSPACE TECHNOLOGY IN BIOLOGY AND MEDICINE

Semiannual Report, Oct. 1970–Mar. 1971
1971 121 p

(Contract NASw-1950)
(NASA-CR-119181) Avail: NTIS CSCL 06E

The accomplishments of the application team are reported. The team has identified 52 new problems for investigation, has accomplished 4 technology applications and 13 potential technology applications, has closed 49 old problems, has reactivated 2 old problems, and on March 31, 1971, had a total of 86 problems under active investigation. Rehabilitation medicine; mental health; detection and treatment of heart, kidney, cancer, and respiratory diseases; artificial organs; health care cost reduction; improved surgical procedures; basic medical research; and miscellaneous problems are summarized. Author

N71-30391# Joint Publications Research Service, Washington, D.C.
SYSTEMS RESEARCH
16 Jun. 1971 30 p ref Transl. into ENGLISH of the book "Sistemnyye Issledovaniya" Moscow, Nauka Publ. House, 1970 p 114–133
(JPRS-53376) Avail: NTIS

Excerpts of philosophical discussions on the systemic analysis in ecology are presented. The importance of tropic links in a biocenosis is examined, and the problems of how to differentiate a system from surrounding subjects and which elements should be included in a biocenosis are considered. The difficulties in deciding the size of ecosystems to study (zooids, populations, or communities) are described, along with the type of result in each situation. The development of the systemic approach in ecology is traced from the organism-medium basis, to extending biocenosis to biogeocenosis, and trophodynamic systems with sensory links added. Problems associated with the qualitative analysis of ecological links are identified as the quantitative description in concepts dealing with the transfer of material, energy, or information, and the description of the structure of ecological systems. N.E.N.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-29308# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
MEDICAL AND PSYCHOLOGICAL ASPECTS OF MASS AIR TRANSPORTATION
S. J. Gerathewohl, S. R. Mohler, and P. V. Siegel Mar. 1971 31 p refs
(FAA-AM-71-10) Avail: NTIS

The increase in air transportation depends not only on the technological progress and the availability of more and larger aircraft, but also on the corresponding increase in flight safety. Since, in most of the aircraft accidents, pilot error is a contributing factor, research concerning the medical and human factors must be expanded to include the new generation aircraft, in particular, the jumbo jets and air buses which are the means of mass air transportation. Moreover, the medical aspects of airports must be adjusted to serve the increasing number of crews, passengers and patients. Means must be provided for first aid, quarantine and the prevention of infectious diseases through air transportation; and a disaster plan must be established for all major airports. Finally, the effects of mass air transportation on the environment must be considered in order to protect the quality of life. Author

N71-29327# Oxford Univ. (England). Engineering Lab.
THE TRANSMISSION OF LOAD THROUGH THE HUMAN HIP JOINT
A. S. Greenwald and J. J. O'Connor 1971 47 p refs Sponsored by Arthritis and Rheumatism Council
(LAB-1002/71) Avail: NTIS

The results of loading experiments carried out on human hip joints during normal walking are described. Two distinct contact areas were found on the anterior and posterior aspects of the acetabulum at light loads, gradually merging with increasing load until, at a certain transition load, the dome of the acetabulum comes into contact and contact is then complete. The value of the transition load depends on the rate of loading, due to creep of the cartilage, and was found to vary from 50% of body weight in young specimens to 25% of body weight for elderly specimens for rates of loading typical of normal walking. The analysis of a much simplified model of the hip joint is presented, the dependence of contact area on load is demonstrated, and a method of determining the transition load for complete contact from the load/deflection relation for the hip is suggested. It is concluded that the function of joint incongruity is to allow the articular surfaces to come out of contact at light loads so that the cartilage may be exposed to synovial fluid for the purposes of nutrition and lubrication. Author (ESRO)

N71-29383*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DESIGN, DEVELOPMENT, AND FABRICATION OF A WATER ELECTROLYSIS SYSTEM FOR A 90-DAY MANNED TEST Final Report
B. M. Greenough and T. M. Olcott 21 Jun. 1971 98 p refs
(Contract NAS1-9728)
(NASA-CR-111911) Avail: NTIS CSCL 06K

A circulating electrolyte water electrolysis system, the electrolytic oxygen generator, was designed, fabricated, and operated. The generator was subjected to tests in which it operated successfully for 100 hours in a continuous, automatic, hands-off mode. The system has provisions for manual startup and shutdown, automatic safety shutdown, and fault diagnosis and performance monitoring by means of front panel indicators. It features automatic control of water balance, temperature, differential pressure, and gas generation rate. The design oxygen generation capacity is 9 lb/day, at a discharge pressure of 21 to 27 psig. Hydrogen is discharged at 9 psig. The system operated successfully for 70 days and was required to furnish oxygen at rates up to 25 percent in excess of its design capability. Author

N71-29437# Southampton Univ. (England). Inst. of Sound and Vibration Research.
EFFECTS OF NOISE UPON SLEEP
P. A. Morgan Dec. 1970 91 p refs
(ISAV-TR-40) Avail: NTIS

The effects of auditory stimuli during sleep and the after effects of sleep deprivation and sleep interference with particular emphasis on the question of sonic boom exposure during sleep are examined. An experimental approach for future work on the effects of sonic booms on sleep is proposed including methods of objective and subjective measurements of sleep interference. ESRO

N71-29479# Biotechnology, Inc., Falls Church, Va.
FORECAST OF HUMAN FACTORS TECHNOLOGY ISSUES AND REQUIREMENTS FOR ADVANCED AERO-HYDRO-SPACE SYSTEMS Final Report
Harold E. Price and James F. Parker, Jr. Mar. 1971 355 p refs
(Contract N00014-69-C-0327)
(AD-721713) Avail: NTIS HC $6.00/MF $0.95 CSCL 5/5

Three major new systems planned for the 1970s have been examined: the supersonic transport, the space shuttle, and undersea systems, covering both underwater habitats and deep sea submersibles. The operation of these systems and the proposed utilization of man within each system have been described in detail. Specific issues relating to the use of man have been discussed. Finally, research requirements have been recommended that should

receive emphasis if appropriate human factors and biomedical technology is to be developed to support the full spectrum of advanced systems to be developed within the next decade. Author (GRA)

N71-29640# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

PROTECTIVE SMOKE HOOD STUDIES

Ernest B. McFadden and Roger C. Smith, eds. Dec. 1970 67 p refs

(FAA-AM-70-20) Avail: NTIS

Evaluation and testing of a high-temperature resistant, transparent, polyimide hood designed to protect aircraft passengers and crew from the effects of toxic fumes, smoke and flame resulting from an aircraft accident are described. The hood was developed to provide protection of the respiratory system and maintain the occupant in a conscious and mobile state so that the aircraft can be evacuated before smoke and high temperatures render the cabin environment uninhabitable. The general smoke hood concept is examined with respect to environmental protection, vision, hearing, safety briefings, and the effect of the hood upon evacuation efficiency. Author

N71-29682# School of Aerospace Medicine, Brooks AFB, Tex.

LONG-TERM AIRCREW EFFECTIVENESS (A LITERATURE STUDY)

George K. Cantrell, Ralph W. Trimble, and Bryce O. Hartman Apr. 1971 15 p refs

(AD-722417; SAM-TR-71-4; SAM-REVIEW-1-71) Avail: NTIS CSCL 6/19

A wide range of factors related to long-term aircrew effectiveness are discussed in this review. The major categories are work environment factors, task factors, personal factors in screening, and personal factors in development. The review identifies such significant problems as gaps in the existing scientific literature and failure to consider interactions between the categories described. Author (GRA)

N71-29685# RAND Corp., Santa Monica, Calif.

THE RELATIVE IMPORTANCE OF CONTRAST AND MOTION IN VISUAL TARGET DETECTION

H. E. Petersen and D. J. Dugas Mar. 1971 38 p refs

(Contract F44620-67-C-0045; Proj. RAND)

(AD-722407; R-688-PR) Avail: NTIS CSCL 6/16

Results of a previous study (see AD-720 800) suggested that the effect of motion on detectability might be caused entirely by contrast changes as the target moves over a complex background. The test documented in the present study, employing a television display and an artificial background, showed independent effects of both contrast and motion on target detectability. The effects can be accounted for by modifying the exponent in the detection probability function with a linear contrast term and a second-power velocity term. Single-fixation experiments confirmed a larger aperture for moving targets than for static targets, and also demonstrated a gradual increase in the fixation time required to detect a target as a function of its distance from the fixation point. Author (GRA)

N71-29783*# Massachusetts Inst. of Tech., Cambridge.

UNIVERSITY ROLE IN ASTRONAUT LIFE SUPPORT SYSTEMS: MONITORING ATMOSPHERIC CONTAMINANTS

H. L. Galiana Washington NASA Jul. 1971 58 p refs

(Grant NGR-22-009-312)

(NASA-CR-1826) Avail: NTIS CSCL 06K

The state of the art in monitoring techniques for biological and chemical atmospheric contaminants is discussed. Brief reference is made to currently accepted allowable contaminant concentrations. An attempt is made to point out areas where there is a need for more research especially suited to graduate school laboratories. Such research should prove invaluable when extended from space capsule to Earth pollution problems. Author

N71-29794# Human Engineering Labs., Aberdeen Proving Ground, Md.

A PROPOSED LIMIT FOR PRINTED-CIRCUIT BOARD INSERTION FORCES

R. Bradley Randall Mar. 1971 13 p refs

(AD-723048; HEL-TN-2-71) Avail: NTIS CSCL 5/5

A study was made to recommend a maximum force level that an individual inserting printed circuit boards (PCBs) into equipment by pushing with his thumbs would not have to exceed to fully seat the PCB. Twenty-four subjects pushed against a simulated circuit card with two handle orientations in each of two directions. Each subject exerted his maximum steady force for three to five seconds, and then lunged to achieve the greatest maximum force possible. A recommended limit of 25 pounds was calculated from the results. This value is achievable by 95.8 percent of the population using a steady push. By lunging, more than 99 percent of the population can exert a 25-pound force. Author (GRA)

N71-29882# Harvard School of Public Health, Boston, Mass.

PSYCHOLOGICAL FACTORS IN SOLAR OBSERVING Final Report, 20 Jan. 1968 - 19 Jan. 1971

Ronald M. Pickett 1 Apr. 1971 30 p refs

(Contract F19628-68-C-0150)

(AD-722471; AFCRL-71-0166) Avail: NTIS CSCL 5/10

The report summarizes the aims of a 3-year program of work concerned with psychological factors in solar observing. Part I identifies several psychological factors which may affect solar observing and outlines a program of research, Part II is a report of a program of studies dealing with the application of visual perceptions in solar flare prediction. Author (GRA)

N71-29903*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF STORABLE PROPELLANT REFORMING FOR USE IN EMERGENCY LIFE SUPPORT SYSTEM DESIGN

Lyle O. Wright Washington Jul. 1971 35 p refs

(NASA-TM-X-2321; E-5520) Avail: NTIS CSCL 06K

The storable propellants Aerozine-50 and nitrogen tetroxide (N2O4) are evaluated as sources of hydrogen, oxygen, potable water, and heat for use in an emergency life support system. Results of these laboratory studies indicate the feasibility of steam reforming Aerozine-50 to obtain hydrogen rich gas. This gas was then processed through a palladium-silver diffusion cell to yield 99.99 percent pure hydrogen. Oxygen was obtained through reforming N2O4 to yield an oxygen rich gas containing nitrogen and residual N2O4. The N2O4 was removed by molecular sieves to yield a 67 percent oxygen - 33 percent nitrogen gas product. The data for these processes were used to estimate the volume and weight of several conceptual emergency life support systems. Comparisons were then made with life support system concepts which involved other hydrogen and oxygen sources. These sources were hydrogen peroxide and cryogenic oxygen for the oxygen supply; hydrazine reforming and cryogenic hydrogen were considered for the hydrogen supply. Author

N71-30126*# Baylor Univ., Houston, Tex.

DEVELOPMENT AND TESTING OF A PROTOTYPE OPERATIONAL SYSTEM FOR AUTOMATIC MONITORING OF SLEEP DURING MANNED SPACE FLIGHT Final Report

James D. Frost 31 May 1971 58 p refs Prepared in cooperation with Methodist Hospital, Houston, Tex.

(Contract NAS9-10747)

(NASA-CR-115071) Avail: NTIS CSCL 06B

A prototype operational system for automatically monitoring sleep during manned space flight was constructed and tested. A number of prototype assemblies which accomplished acquisition of EEG, EOG, and head-motion activity, analysis of data to provide

an automatic indication of sleep states, and display of the results over time were incorporated into the operational system with various degrees of modification. The resultant prototype has been evaluated in terms of its overall suitability for use in a space-flight situation. Acquisition of EEG and EOG signals is accomplished by utilization of prefilled sponge-type electrodes incorporated into a disposable elastic cap. A preamplifier and accelerometer assembly unit is attached to the recording cap during use and provides initial amplification for the EEG and EOG activity. A dual-axis accelerometer is included and provides information regarding lateral and vertical head movements to the analysis circuitry for use in artifact discrimination. The EEG, EOG, and head-motion signals are processed by the automatic onboard equipment to provide an output signal representative of the subject's current sleep status. The output is provided in a form suitable for telemetry at a low sample rate. Author

N71-30127# Flying Personnel Research Committee, London (England).

A LABORATORY COMPARISON OF THREE METHODS OF PERSONAL CONDITIONING

J. R. Allan, M. F. Allnutt, M. Beeny (RAE, Farnborough, England), R. de G. Hanson, J. Morrison et al Jan. 1971 43 p refs Prepared in cooperation with RAE, Farnborough, England
(FPRC-1307) Avail: NTIS

Twelve subjects were used to obtain comparative data between a water cooled, a convective air cooled, and a reverse flow air cooled personal conditioning system during laboratory simulations of a typical operational sortie in a hot climate. The results generally favored the water cooled system on physiological, behavioral and subjective grounds. The results of this laboratory trial may not necessarily transfer to realistic operating conditions and further field testing both in flight and using appropriate ground equipment is required before it can be shown whether these advantages can be realised. Author

N71-30140*# Techtran Corp., Glen Burnie, Md.

THE DYNAMICS OF THE ELECTROENCEPHALOGRAM DURING SLEEP IN MAN UNDER NORMAL AND DAILY REGIMES [DINAMIKA ELEKTROYENTSEFALOGRAMMY VO VREMAY SNA CHELOVEKA PRI OBYCHNOM I IZMENENNYKH SUTOCHNYKH REZHIMAK]

A. N. Litsov Washington NASA Jul. 1971 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 4, Jul.–Aug. 1970 p 521–529
(Contract NASw-1695)
(NASA-TT-F-13679) Avail: NTIS CSCL 06B

The electroencephalographic stages of sleep were studied in 28 healthy subjects under various regimes of sleep and wakefulness. During normal 24 hour regimes (sleep from 2300 to 0800) eight subjects showed typical electroencephalographic stages A, B, C, D, E, and PF, similarly described by other investigators under normal conditions. Orthodox sleep under this arrangement constituted 75–92% average per night, and paradoxical sleep constituted 8.3–36.1%. Moreover, the greatest expression of the paradoxic phase was most often observed in the early hours of the day. With a sudden change in the regime of sleep and wakefulness (in 8 subjects with sleep from 0500 to 1400 hours, and in 12 from 1400 to 2300 hours) the disturbed in the qualitative (predominance of the stages of superficial sleep) as well as in the quantitative (dimunition of its duration) relationship. When the subjects remained under variable reginmes there was a gradual improvement in sleep and in the qualitative and quantitative relationships. A more rapid improvement in sleep came with the first move of the regime (sleep from 0500 to 1400 hours), slower during the second move of the regime (sleep from 1400 to 2300 hours). Author

N71-30218# Yale Univ., New Haven, Conn. Dept. of Administrative Sciences.

MAN-COMPUTER INTERACTION IN A DECISION MAKING ENVIRONMENT Annual Report, 1 Feb. 1970–31 Jan. 1971

Robert B. Fetter Mar. 1971 57 p refs
(Contract N00014-67-A-0097-0010)
(AD-722336; AR-1) Avail: NTIS CSCL 5/2

An experiment was formulated, conducted, and results reported involving video and teletype consoles in an information retrieval environment. In conjunction with the development of an information system, a capability to simulate a variety of problem solving environments and automatically evaluate results was designed and programmed. This included the ability to give users on-line feedback of their relative effectiveness. Basic information relevant to further research was gathered, including: a bibliography of research in man-computer interaction; and a file of information on available computer consoles. Author (GRA)

N71-30219# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

CHROMATIC PATTERN RECOGNITION

Charles W. Blackford, Jr. (M.S. Thesis) Mar. 1971 54 p refs
(AD-722853; GE/BE/71-4) Avail: NTIS CSCL 6/4

An achromatic pattern recognition model is modified to process chromatic objects. The theory of color television is used to obtain pattern information in terms of one luminosity and two opponent chromaticity functions. Two-dimensional Fourier transformations of the two color functions are performed. Color identification is then made by correlation with transform prototypes of colored chips previously derived and stored. The object is identified in a similar manner by transforming its luminosity function A digital simulation of the model is conducted using the English alphabet and 84 colors representative of the color spectrum. All letters and their colors are successfully identified, including conditions where pattern brightness varies. Characters were also identified when the chromaticity varied. It is concluded that the modified model can be trained to identify any objects color. Author (GRA)

N71-30234# Naval Ship Systems Command, Washington, D.C.

PROCEEDINGS OF US NAVY HUMAN RELIABILITY WORKSHOP

James P. Jenkins Feb. 1971 343 p refs Conf. held at Washington, D.C., 22–23 Jul. 1970
(AD-722689; NAVSHIPS-0967-412-4010) Avail: NTIS CSCL 5/5

Overview of Project W 43-13 X human factors engineering technology Criteria for development of human reliability methodology. Some recent efforts toward the development of a human performance reliability data system and supportive human performance reliability principles, Development of a human error rate data bank, Quantification of human performance reliatility research method rationale, Man-machine modeling-some current deficiencies and future needs, Reliability and independence, Developing a human reliability prediction method, A human performance data bank for command control and the progressive inference approach to development of data resources for predicting human reliability. GRA

N71-30238# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

CLOTHING AVIATION Final Report

19 Mar. 1971 35 p refs
(AD-723030; MTP-7-2-087) Avail: NTIS CSCL 15/5

The document provides test methodology and testing techniques necessary to determine the technical performance and safety characteristics of aviation tools and associated accessories as described in Materiel Needs (MN) and to determine the items suitability for service tests. Author (GRA)

N71-30254# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

PERSONNEL TRAINING Final Report

15 Mar. 1971 13 p
(AD-723032; MTP-7-3-501) Avail: NTIS CSCL 5/9

The document provides methods and techniques used to train and familiarize Aviation Test Board personnel with aviation equipment, subsystems, systems, and related accessories which are to undergo service testing. Methods are provided for the evaluation of training programs, personnel skill levels, and the proficiency required to adequately prepare, operate, and maintain designated aviation material during conduct of the service test. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-29204# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
CARBON TRANSPORT METHODS UNDER A TEMPERATURE GRADIENT IN FLOWING SODIUM
P. Roy and G. P. Wozadlo Apr. 1970 16 p refs
(Contract AT(04-3)-189)
(GEAP-13569) Avail: NTIS

The state of knowledge on the mode and mechanism of carbon transport, primarily in austenitic systems, is discussed. Included also is a discussion of the effect of carbon transfer on mechanical properties and microstructural changes of austenitic stainless steel after sodium exposure. Author (NSA)

N71-29218 National Lending Library for Science and Technology, Boston Spa (England).
METHODS OF EXPERIMENTAL INVESTIGATION OF EQUILIBRIA IN TWO COMPONENT AND MULTICOMPONENT VAPOUR-LIQUID SYSTEMS [METODY EKSPERIMENTALNOGO ISSLEDOVANIYA RAVNOVESIYA V DVOINYKH I MNOGOKOMPONENTNYKH SISTEMAKH PAR-ZHIDKOST]
B. D. Metyushev et al Jan. 1971 18 p refs Transl. into ENGLISH from Pishch. Prom. (Kiev), no. 7, 1968 p 155–162
(NLL-RTS-5768) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.70; 6 NLL photocopy coupons

The experimental determination of data on vapor-liquid equilibria involves the removal of samples of the liquid and vapor phases in equilibrium and analytical determination of the concentrations of both phases. The liquid-vapor equilibrium is studied at either constant pressure or at constant temperature. Measurements are mostly carried out under isobaric conditions so that such data are more useful in calculations on processes of distillation and rectification and are more easily obtained experimentally. At present, different experimental methods are used distillation, circulation, dew point and boiling, flow and static methods. Author

N71-29226*# Scientific Translation Service, Santa Barbara, Calif.
REACTION OF MONOMOLECULAR SILICA IN SOLUTION WITH Al(3+) AND Mg(2+) [REACTION DE LA SILICE MONOMOLECULAIRE EN SOLUTION AVEC LES IONS Al(3+) ET Mg(2+)]
R. Wey et al Washington NASA Jun. 1971 25 p ref Transl. into ENGLISH from Colloq. Intern. Centre Natl. Rech. Sci. (Paris), no. 105, 1962 p 11–23
(Contract NASw-2035)
(NASA-TT-F-13684) Avail: NTIS CSCL 07B

The solubility of SiO_2 in H_2O is discussed. At 20 C and pH approximately 7, the solubility is 120 to 140 ppm of SiO_2. The solubility is constant when the pH is less than 9, but in more alkaline media the $Si(OH)_4$ molecule dissociates into ions and the solubility increases exponentially. The solubility depends on the temperature and the form of aggregation. It is independent of $Na(+)$, $Cl(-)$, $SO_4(2-)$, and $Ca(2+)$ ions in the solution. The $Mg(2+)$ ion easily forms crystalized products of the clay type, but $Al(3+)$ does not. The action of $Al(3+)$ and $Mg(2+)$ on a saturated silica solution were studied systematically. Author

N71-29240# Montana State Univ., Bozeman. Dept. of Aerospace and Mechanical Engineering.
HIGH-TEMPERATURE OXIDATION OF IRIDIUM Annual Progress Report
R. T. Wimber 20 Feb. 1971 70 p refs
(Contract AT(45-1)-2228)
(RLO-2228-T-1-1; APR-1) Avail: NTIS

The rates at which iridium oxidized at temperatures in the range of 1600 – 2200 (2910 – 4000 F) and pressures in the range of 1 – 1,000 torr are being measured and compared to theoretically predicted rates. A model was constructed and used in the derivation of a rate equation for the steady-state condition in which the net rate of consumption of iridium by reaction at the gas-solid interface is equated to the rate of diffusion of $IrO_2(g)$ and $IrO_3(g)$ through the gaseous boundary layer. The experimental equipment is of a design which allows measurement of oxidation rates under conditions where heat transfer coefficients are known and may be used in the calculation of the mass transfer coefficients contained in the derived rate equation. Author

N71-29427# Naval Research Lab., Washington, D.C. Chemistry Div.
ANALYSIS OF SUBMARINE ATMOSPHERES
F. E. Saalfeld, R. A. Saunders, and F. W. Williams *In its* Rept. of NRL Progr., May 1971 May 1971 p 1–9 refs (See N71-29426 17-30)
Avail: NTIS

The determination of trace contaminants of enclosed atmospheres was discussed. Such contaminants are of particular concern in nuclear submarines, because some of the contaminants are either toxic or corrosive. No single instrument or technique was developed that can characterize all known contaminants. Among the many developed techniques of analysis are: the gas chromatography-microcoulometer method, which is sensitive (from 10 parts per billion to 10 parts per million) to all halogen-containing organic compounds except fluorides; and the stop-flow, gas chromatography-mass spectrometry method, which permits the identification of the constituents of very complex mixtures. Author

N71-29538# Joint Publications Research Service, Washington, D.C.
METHOD OF SOLUTION OF MULTICRITERIAL PROBLEMS OF CONTROL OF COMPLEX CHEMICAL-TECHNOLOGICAL SYSTEM
V. V. Kafarov et al *In its* Cybernetics and Regulation Theory 18 Jun. 1971 p 7–10 refs (See N71-29536 17-10)
Avail: NTIS

Standard criteria space is used for finding the solution to multicriteria problems that ensures the minimum difference between the values of the purpose functions and individual optima. The method permits operation in the entire range of permissible solutions. With the limitation $AX < \text{or} = B$, solutions are obtained which convert each purpose function of F(X) individually to a minimum or maximum. The product of matrix A in vector X characterizes all forms of expenses that are of interest. The method was tried under industrial conditions of a complex chemical combine, and the computer program used permitted solution of problems containing up to 40 variables. N.E.N.

N71-29587*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HIGH PRESSURE HYDROGEN EFFECTS ON MATERIALS

W. McPherson *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 363-378 (See N71-29576 17-28)

Avail: NTIS HC$6.00/MF$0.95 CSCL 07D

The effects of a high pressure, gaseous hydrogen (GH-2) environment at room temperature on the stability of a number of alloys and metals are discussed and graphically illustrated. Strength reduction is particularly evident in notched tensile tests, in which the degree of embrittlement or degradation generally increases proportionately to the strength of the material. In addition, the degree of degradation: (1) increases with GH-2 pressure; (2) reaches a maximum near room temperature; (3) increases with GH-2 purity; and (4) is independent of time in the environment. A.C.R.

N71-29624 Ohio State Univ., Columbus.

THERMAL DECOMPOSITION OF HYDROGEN PEROXIDE VAPOR AT ELEVATED TEMPERATURES BEHIND INCIDENT AND REFLECTED SHOCK WAVES

Kashi Ramamurthi Bilwakesh (Ph.D. Thesis) 1969 106 p

Avail: Univ. Microfilms Order No. 70-13981

The homogeneous thermal decomposition of hydrogen peroxide highly diluted in argon or nitrogen has been investigated behind incident and reflected shock waves. The heterogeneous decomposition of the hydrogen peroxide on the walls of the shock tube at room temperature was reduced by a considerable extent by lining the stainless steel shock tube with polyethylene. The rate of disappearance of hydrogen peroxide was measured by monitoring the absorption by hydrogen peroxide of the ultraviolet radiation at 2537 A provided by an Osram high pressure mercury lamp and at 2600 A and 2900 A provided by an Osram high pressure xenon lamp. It has been shown that the thermal decomposition of hydrogen peroxide occurs via the initial breaking of the O-O bond of the peroxide molecule yielding two OH radicals. Under the conditions investigated, this initiating step occurs as a uni-molecular decomposition of the second order requiring a critical energy for activation of 49 kcal/mole assuming four effective classical oscillators for both argon and nitrogen diluents. Dissert. Abstr.

N71-29669 National Lending Library for Science and Technology, Boston Spa (England).

SPECTROPHOTOMETRIC INVESTIGATION OF OXALATE COMPLEXING OF TRIVALENT IRON IN AQUEOUS SOLUTIONS

K. M. Yakubov et al 1970 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Tadzh. SSR (USSR), vol. 12, no. 12, 1969 p 33-37

(NLL-CE-Trans-5509-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An investigation of complexing is presented in the Fe(+3) - C2O(-2) OH(-) system in a wide range of oxalic acid concentratons and pH values. From an analysis of the relationship between the optical density of the solutions and the pH and oxalic acid concentrations, an attempt is made to establish the complex forms which develop and to calculate their dissociation constants. Author

N71-29684# Leeds Univ. (England). Dept. of Electrical and Electronic Engineering.

MAXIMIZATION OF ARGON-HYDROCARBON PENNING MIXTURES

A. E. D. Heylen Repr. from J. Phys., D: Appl. Phys. (London), v. 3, 1970 p 789-796 refs Revised

(Contract F61052-68-C-0013)

(AD-722313; AFCRL-71-0108) Avail: NTIS CSCL 7/4

Townsends primary and secondary ionization coefficients have been measured in 0.003, 0.03, 0.3 and 3% of n-pentane, ethylene and acetylene mixed in argon for a total pressure in the range 0.5 to 500 torr and for a uniform field gap up to 1 cm. For n-pentane, a concentration of 15% was also employed. A marked Penning effect is again observed and is greatest in about 0.1% of acetylene in argon; the enhancement of Townsends primary ionization coefficient in this mixture exceeds that previously observed in the classical rare gas mixtures. As usual, the hydrocarbons are observed to be efficient quenching agents, acetylene in this respect being the less efficient. At an optimum concentration of 0.03% for all the mixtures the sparking voltage is lowered considerably below that for pure argon, the lowering being the most--and amounting to a factor somewhat greater than 4--in argon-acetylene mixtures. Author (GRA)

N71-29687# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.

THE EFFECT OF IONIZING RADIATION ON CARBON MONOXIDE CHEMISORPTION ONTO CARRIER-FREE IRON PRECIPITATION CATALYSTS [ZUM EINFLUSS IONISIERENDER STRAHLEN AUF DIE CHEMISORPTION YON KOHLENMONOXID AN TRAEGERFREIEN EISENFAELLUNGSKATALYSATOREN]

Ingo Witte (Ph.D. Thesis) 1969 108 p refs In GERMAN

Avail: NTIS

Experimental measurements of carbon monoxide chemisorption onto iron precipitation catalysts proved higher adsorption values for alpha-activated contacts than for inactive comparative contact surfaces; the increase of about 20% was far above the error limit. Beta activated contact surfaces produced analog values in proportion to the per gram adsorbed gas volume. Both ionizing radiations induced Frenkel defects in the iron catalysts that annealed through thermal treatment or at decreased radioactivity. Transl. by G.G.

N71-29688# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.

ON THE CHEMISORPTION OF CARBON MONOXIDE, HYDROGEN AND THEIR MIXTURES ONTO IRON FILMS [ZUR CHEMISORPTION VON KOHLENOXID, WASSERSTOFF UND DEREN GEMISCHEN AN EISENFILMEN]

Hans Nitschke (Ph.D. Thesis) 1969 168 p refs In GERMAN

Avail: NTIS

Low gas pressure effects of the carbon monoxide and hydrogen adsorption properties on vacuum deposited iron films are evaluated for simultaneous as well as consecutive processing of both components. Obtained measurements of thin film resistance changes and electron charge potentials provide a pronounced film resistance dependence on the gas exposure sequence; a carbon monoxide-hydrogen sequence produces much higher resistance increases than a hydrogen-carbon monoxide sequence. Simultaneous adsorption of both gases did not increase the film resistance. Electro-optical measurements of the electron charge potentials found for carbon monoxide exposed iron films; twice as high values as for hydrogen exposed films; mixed gas adsorption electronic potentials corresponded to those of the monoxide exposure for iron film surfaces. Transl. by G.G.

N71-29695 Illinois Univ., Urbana.

ANALYSIS AND ELECTROCHEMISTRY OF SEMICONDUCTING TIN OXIDE

David Louis Zellmer (Ph.D. Thesis) 1969 170 p

Avail: Univ. Microfilms Order No. 70-13554

Semiconducting thin films of antimony doped tin oxide on glass were analyzed for nonstoichiometry and other impurities in an attempt to explain the electrochemical behavior of the material. The tin oxide was dissolved with retention of Sn(2) by heating for several hours in LiCl-KCl eutectic saturated with anhydrous HCl. Under these conditions SnCl4 is lost from the melt, but Sn(2) is retained. Anodic stripping analysis of aqueous solutions of this eutectic permitted detection of 0.01 mole % Sn(2) in the

tin oxide thin film, as well as certain other impurities. Emission spectrographic analysis was used to determine traces of other materials. The film was found to contain 0.02 to 0.3 mole % Sn(2), 2.5 mole % antimony, traces of silicon, and highly variable amounts of copper on the surface. The concentration of Sn(2) in the film was of the correct order to explain partially the conductivity of tin oxide not doped with antimony; it was too low, however, to produce significant amounts of intrinsic electrochemical current-voltage behavior. Dissert. Abstr.

N71-29856# DuPont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

EFFECT OF GAMMA RADIATION ON ADSORPTION OF IODINE AND METHYL IODIDE ON ACTIVATED CARBON

L. R. Jones *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 526-538 refs (See N71-29851 17-13)
(Contract AT(07-2)-1)
Avail: NTIS HC$6.00/MF$0.95

The effect of gamma radiation on the adsorption of iodine and methyl iodide on activated carbon exposed to flowing mixtures of steam and air is being measured. The steam-air-iodine mixtures are exposed to a radiation field of approximately 1.7×10 to the 7th power rads/hr while flowing through a bed of test carbon. Test conditions simulate a postulated loss-of-coolant accident where adsorption of radio-iodine on carbon beds would produce an intense gamma radiation field. The test facilities and results of tests that are under way to define the effects on carbon adsorption efficiency of variables such as face velocity, relative humidity, temperature, type of carbon, carbon service age, iodine and methyl iodide concentration in the steam-air mixture, and loading on the carbon are described. Author (NSA)

N71-29857# DuPont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

EFFECT OF SERVICE ON RETENTION OF IODINE BY ACTIVATED CARBON

A. G. Evans *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 539-550 refs (See N71-29851 17-13)
(Contract AT(07-2)-1)
Avail: NTIS HC$6.00/MF$0.95

Activated carbon is installed in many reactor confinement systems to remove radioiodine from effluent gases in the unlikely event of a nuclear accident. For on-line confinement systems in which reactor building ventilation air and vent gases continuously pass through carbon beds, iodine retention and effective surface area of the carbon both decrease with increasing time. Coconut shell carbon used in the confinement systems at the Savannah River Plant was found to contain increasing amounts of trace gaseous pollutants (CO_2, NO, CO, H_2, and ethylene) with increasing service. The most significant pollutant was NO_2, which was formed in the air around the reactor tank. The NO_2 reacts with the carbon in the confinement system forming CO and NO, which destroy or occupy three active carbon sites for each NO_2 molecule reaching the carbon bed; thus, the iodine removal efficiency of the carbon is decreased. Author (NSA)

N71-29860# Idaho Nuclear Corp., Idaho Falls.

A STUDY OF THE ADSORPTION PROPERTIES OF METAL ZEOLITES FOR AIRBORNE IODINE SPECIES

D. T. Pence, F. A. Duce, and W. J. Maeck *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 581-599 refs (See N71-29851 17-13)
(Contract AT(10-1)-1230)
Avail: NTIS HC$6.00/MF$0.95

A detailed investigation of the properties and characteristics of both silver zeolite and other materials for the adsorption of various airborne iodine species is being conducted. The objectives of this program are to thoroughly investigate the adsorption properties of silver zeolite, prepare and investigate the properties of other metal zeolites for airborne iodine species, to more fully evaluate the most promising materials, and finally to provide support for full scale testing. Current laboratory studies include various methods for the preparation of silver zeolite; methyl iodide adsorption as a function of humidity, temperature, face velocity, and bed depth; desorption of iodine; loading capacity as a function of airborne iodine species concentration and flow rate; and product solubility. Similar studies have also been conducted for other selected metal zeolites. A limited number of charcoal adsorption tests have been conducted to provide comparison data. Author (NSA)

N71-29861# Harvard School of Public Health, Boston, Mass.

ANALYSIS OF CONCURRENT ADSORPTION AND CHEMICAL REACTION IN PACKED BEDS

Dwight W. Underhill *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 600-606 refs (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

A series of equations were developed to describe accurately concurrent adsorption and chemical reaction of gases in packed granular beds. These equations use analysis by statistical moments to develop a straightforward, rapid method for calculating breakthrough curves. A useful feature of these equations is that they provide a method for calculating the fraction of adsorbate that will pass through the bed unreacted. Author (NSA)

N71-29862# Idaho Nuclear Corp., Idaho Falls.

APPLICATION OF METAL ZEOLITES TO RADIOIODINE AIR CLEANING PROBLEMS

W. J. Maeck and D. T. Pence *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 607-620 refs (See N71-29851 17-13)
(Contract AT(10-1)-1230)
Avail: NTIS HC$6.00/MF$0.95

The use of fully loaded zeolite as an adsorbent for airborne iodine in reactor containment filter systems and detailed investigations of the iodine adsorption properties of silver and other metal-loaded zeolites have suggested several other potential applications for these materials. One important application is the removal of iodine from the off-gas of nuclear fuel processing plants. The high temperature operability of metal zeolites makes them attractive for this application. The use of tandem beds containing different metal-loaded zeolites and the advantages of using heated beds are discussed. An examination of the economics of metal zeolites shows the use of these materials to be practical for many iodine air cleaning applications. Author (NSA)

N71-29897# Stanford Research Inst., Menlo Park, Calif.

SENSITIVITY FUNDAMENTALS Semiannual Technical Progress Report, 1 Sep. 1970 - 28 Feb. 1971

David S. Ross, Robert Shaw, and Robert Woolfolk 9 Apr. 1971 64 p refs
(Contract N00014-70-C-0190)
(AD-722483; SRI-TPR-71-1) Avail: NTIS CSCL 7/3

The report summarizes research on the relationship between detonation phenomena, chemical structure and kinetics for isomeric dinitropropanes and other nitroalkanes. Research on dinitropropanes is being carried out in three areas: high velocity detonation(HVD), low velocity detonation (LVD), and kinetics of thermal decomposition. Densities, sound speeds, and heat capacities have been measured for several dinitroalkanes. Group additivity values developed from these measurements were used to calculate values of C(p) for several additional dinitroalkanes. LVD gap sensitivity measurements on 2,2-dinitropropane and 1,1-dinitroethane showed that the former did not and the latter did undergo LVD. HVD sensitivities measured for nitromethane, 2,2-dinitropropane, 1,1-dinitroethane, and

1,1-dinitropropane increased with temperature and with decreasing charge diameters. LVD sensitivity seemed to increase with an increase in the oxygen balance; compounds producing free carbon. Author (GRA)

N71-29915# Technische Hochschule Hannover (West Germany). Institut fuer Technische Chemie.

INFLUENCE OF DIMENSIONS OF GAS FLUIDIZED BEDS ON GAS MIXING

B. Lentzsch Nov. 1970 80 p refs In GERMAN
(BMBW-FBK-70-26) Avail: AEC Depository Libraries

The influence of the length and diameter of fluidized bed reactors on gas mixing was investigated at various velocities of the fluidizing gas. Coefficients of axial, radial, and back mixing of the gas were derived by means of a dispersion model. The diameters of the reactors were 19.2, 35.2, and 50.0 cm. The ratio of length to diameter was varied between 25 to 50 and 80 to 20. Quartz sand with an average particle diameter of 162 mu m was used as solid material; it was fluidized by air. The intensity of axial mixing increased with the square root of the bed height and approached with increasing bed diameter as well as velocity a limiting value. The intensity of radial and back mixing amounted to 5 to 10% of axial mixing. Author (NSA)

N71-30074 Wisconsin Univ., Madison.

ISOTHERMAL FREE DIFFUSION IN LIQUIDS: CALIBRATIONS OF A NEW OPTICAL DIFFUSIOMETER, NEW CALCULATION PROCEDURES FOR TERNARY SYSTEMS, AND DATA FOR THE SYSTEM TETRABUTYLAMMONIUM BROMIDE-WATER AT 25 C

Arnold Revzin (Ph.D. Thesis) 1969 214 p
Avail: Univ. Microfilms Order No. 70-3676

A new optic diffusiometer was constructed in order to make improved studies of isothermal diffusion in liquid systems using the Gouy method and other optical techniques. The new instrument, which is a special type of precision optical bench, was designed to give more accurate results than previous models, as well as to be more versatile. Some of the calibrations and testing of the new diffusiometer, and its use in making accurate diffusion measurements are described. Part 1 contains descriptions of some calibrations performed during construction of the instrument. Part 2 deals with two theoretical problems. The first involves the calculation from Gouy diffusiometer data of the four diffusion coefficients describing solute flows in three-component systems. The second problem considered is the effect of a wedge-shaped diffusion cell on the measured value of the diffusion coefficient. In Part 3 are presented the results of measurements of the diffusion of tetrabutylammonium bromide (Bu4NBr) in aqueous solution at 25 deg. Dissert. Abstr.

N71-30212*# Scientific Translation Service, Santa Barbara, Calif.

PRODUCTION OF AMINOACETONITRILE METAL CHAINS AND THEIR CATALYTIC EFFECTS [AMINOASETONITORIRU KINZOKY SAKUTA: NO GOSE; TO SONO SHOKUBAI-SAYO NI TSUITE]

Katsuhiro Kawashiro (M.S. Thesis - Tokushima Univ., 1969) Washington NASA Jul. 1971 91 p refs Transl. into ENGLISH of Japanese thesis
(Contract NASw-2035)
(NASA-TT-F-13711) Avail: NTIS CSCL 7/4

The experimental methods are described that were used for the production of: (1) aminoacetonitrile acetate; (2) aminoacetonitrile copper chains; (3) aminoacetonitrile zinc, nickel, and cobalt chains in methanol; (4) reactivity of Cu(AAN)2SO4 coordinators with formaldehyde, acetoaldehyde and acrylonitrile; and (5) catalytic action of metal chains in Sorbitol and glycerine oxidation. Author

N71-30213 National Lending Library for Science and Technology, Boston Spa (England).

BASIC RESEARCH ON COUNTERCURRENT CONTINUOUS GAS CHROMATOGRAPHY [KORYUKEI RENZOKU GASU KUROMATOGURAFU NO KISOTEKI KENKYU]

S. Araki et al Mar. 1971 17 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 73, no. 5, 1970 p 77-82
(NLL-RTS-6323) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.60; 5 NLL photocopy coupons

Experimental studies were undertaken of a countercurrent continuous gas chromatograph of increased throughput achieved by causing the carrier gas to flow in the opposite direction to the liquid (PEG 400) while introducing samples continuously. The separation conditions of the two constituent system were deduced as functions of the temperature of the separation tube, carrier gas flow rate, and liquid (PEG 400) flow rate. An actual separation was effected of the cyclohexane (bp 80.7 C) and benzene (bp 80.1 C) system of very near b.p., with the n-hexane/ethyl alcohol system forming an azeotropic mixture. The number of theoretical plates was also examined and equations for obtaining it were studied. Author

N71-30224 Washington Univ., Seattle.

DISSOLUTION OF NETWORK POLYMERS BY CHEMICAL DEGRADATION

Howard Wyatt Gardner (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms Order No. 70-14755

To describe the rate of dissolution of network polymers by chemical degradation, the theories of gel formation in polymer systems were studied. The model used to describe dissolution behavior predicts that the rate of dissolution will accelerate as the degradation proceeds until dissolution is suddenly complete at the critical gel point. Acid hydrolysis experiments with a dextran gel were conducted in order to verify the predictions. Results of kinetic experiments support application of a pseudo-homogeneous first order rate law to the hydrolysis reaction of constant acid concentration. The rate constants at 100 C in 0.121 N hydrochloric acid were determined for various gels. The dissolution rate was found to accelerate even more markedly than predicted by the model as total dissolution was approached. Primary causes of this discrepancy are probably failure of existing gel theories to account for intramolecular crosslinks and possible retention of sol molecules in the gel by physical entrapment during early stages of the dissolution. Dissert. Abstr.

N71-30227# Mound Lab., Miamisburg, Ohio.

REPRESENTATIVE ANALYTICAL METHODS FOR SELECTED METAL IONS

R. K. Gillette 12 Mar. 1971 50 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1801) Avail: NTIS

The following representative analytical techniques as used for certain metallic ions are recorded in detail: spectrophotometry, neutron activation analysis, atomic absorption spectrophotometry, fluorescence analysis, emission spectroscopy, photometric titration, solvent extraction, ion exchange, spark source mass spectroscopy, and X-ray emission analysis. Wherever possible concentration ranges, interferences, sensitivity, accuracy and precision data are included. Suggested improvements on certain analytical techniques that may remove interferences in some current methods as well as improve accuracy and precision in various measurements are given. Author (NSA)

N71-30228# Reactor Centrum Nederland, Petten.

DETERMINATION OF OXYGEN TO URANIUM RATIO IN HYPOSTOICHIOMETRIC URANIUM DIOXIDE

A. Tolk, W. A. Lingerak, and D. Boerger Sep. 1970 10 p refs
(RCN-128) Avail: AEC Depository Libraries

A method in which the sample is dissolved in concentrated phosphoric acid is used for the determination of the O/U ratio in hypostoichiometric uranium dioxide UO(2-y). During dissolution the following overall reaction occurs: UO(2-y)+H(+) yields U(4)+(2-y)

H2O + γ H2. The amount of released hydrogen is measured by gas chromatography. In a new version of this method the sample is dissolved in phosphoric acid at 250 to 275 C in a closed vessel for a maximum of 60 hours. The hydrogen is then swept away from the solution in one stroke by a helium stream and analyzed in the original way. For test samples of metallic uranium the amount of released hydrogen measured was 99 to 100 % of the theoretical value. Author (NSA)

N71-30230# Rice Univ., Houston, Tex.
ION MOLECULE REACTIONS OF CH4-CD4 MIXTURES AT HIGH PRESSURES
Shuang-Ling Chong and J. L. Franklin Mar. 1971 30 p refs
(Contract N00014-67-A-0226-0005; Proj. SQUID)
(AD-722687; RICE-10-PU) Avail: NTIS CSCL 7/4

Ion-molecule reactions in mixtures of CH4 and CD4 at pressures up to about 0.65 torr have been carried out in a single ion source of a quadrupole mass filter. Fromthe isotope distribution in the ethyl ions, it is evident that randomization occurs in the complex of methyl ions with methane. There is no evidence for reaction of ethyl ion with methane. Simularly, methane ions react with methane to form CH5(+), CH4D(+0), CD4H(+), and CD5(+). The ratios of products are very nearly what would be expected from reactions of methane ion with methane rather than from transfer of protons and deuterons from methanium ion. H and D atoms appear to be transferred at equal rates but deuterons are transferred at only about six-tenths the rate of transfer of protons. Author (GRA)

N71-30286# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
ACTIVATION ANALYSIS: A BIBLIOGRAPHY, PART 1
G. J. Lutz, R. J. Boreni, R. S. Maddock, and W. W. Meinke, eds. May 1971 477 p refs
(NBS-TN-467-Pt-1) Avail: SOD $5.25

References to papers published in the open literature up to January 31, 1971, which describe work using activation analysis are presented from a computer based storage and retrieval system. A listing of references according to accession numbers (approximately 5300) is given. Author

N71-30287# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
ACTIVATION ANALYSIS: A BIBLIOGRAPHY. PART 2: APPENDICES
G. J. Lutz, R. J. Boreni, R. S. Maddock, and W. W. Meinke, eds. May 1971 202 p refs
(NBS-TN-467-Pt-2) Avail: SOD $5.25

References to papers describing work using activation analysis in the open literature up to January 31, 1971 are presented from a computer based storage and retrieval system. Indices for the element determined, matrix analyzed, technique used and an author index are given for the 5300 references. Author

N71-30320*# Scientific Translation Service, Santa Barbara, Calif.
FAR INFRARED ABSORPTION SPECTRUM OF LIQUID WATER [INFRAKRASNYY SPEKTR POGLOSHCHENIYA ZHIDKOI VODY V DALEKOY OBLASTI]
D. V. Andreyev et al Washington NASA Jul. 1971 17 p refs Transl. into ENGLISH from Probl. Fiz. Atmos. (Leningrad), no. 8, 1970 p 59-69
(Contract NASw-2035)
(NASA-TT-F-13746) Avail: NTIS CSCL 07D

Measurements were made of the absorption spectra of liquid water in the range from 40 to 400/cm. A detailed description is given of these measurements (made with the aid of a Fourier spectrometer), and the information which can be correctly deduced from these measurements is indicated. All available data on absorption of liquid water in the range from 25 to 250 microns are discussed. A table of transmission coefficients of liquid water is presented. Author

N71-30332# Royal Aircraft Establishment, Farnborough (England).
PREPARATION OF POLYESTERS AND A POLYANHYDRIDE CONTAINING PHENYLENE-PERFLUOROALKYLENE UNITS
V. C. R. Mc Loughlin, J. Thrower, M. A. H. Hewins, J. S. Pippett, and Mary A. White Sep. 1970 33 p refs
(RAE-TR-70160) Copyright. Avail: NTIS

Meta- and para-oriented aromatic dicarboxylic acids of the type HOOCC6H4(CF2)nC6H4COOH, where n=3 and 5, and a diphenol, m,m'-HOC6H4(CF2)3C6H4OH, have been prepared and used to make a range of polyesters and a polyanhydride. Polyesters from the acids and 2,2,3,3,4,4-hexafluoro pentane 1,5-diol showed that introduction of meta-oriented perfluoro alkylene groups led to lowered glass transition temperatures, but not enough to afford new useful elastomers. Similar lowering of glass transition temperatures was observed in polyesters from bisphenol-A and by modification of a wholly aromatic polyester and polycarbonate. Author (ESRO)

N71-30349*# Ottawa Univ. (Ontario). Dept. of Chemistry.
STUDIES ON ELECTROCHEMICAL FORMATION AND REDUCTION OF OXIDE FILMS ON NOBLE AND TRANSITION METALS Semiannual Report
Jun. 1971 35 p refs
(Grant NGR-52-093-001)
(NASA-CR-119188) Avail: NTIS CSCL 07D

Structural details are resolved in the anodic formation of surface oxides at platinum by the potentiodynamic sweep method. Measurements provided new information on the aspects of irreversibility of platinum oxidation and reduction processes which are associated with hysteresis. The very initial stages of the plantinum oxidation and reduction are reversible but even with coverages corresponding to only 10% of the surface, some irreversibility becomes significant after some period of holding at the anodic end of the potential sweep, even at these low coverages. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-29213*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DEVELOPMENT OF CIRCUITRY FOR A MULTIKILOWATT TRANSMITTER FOR SPACE COMMUNICATIONS SATELLITES
20 Feb. 1971 223 p refs
(Contract NAS8-24771)
(NASA-CR-119803) Avail: NTIS CSCL 17B

A high power, high efficiency UHF transmitter was developed to serve as the basis for an optimum satellite transmitter for AM-TV broadcasting. The transmitter employs a highly unique UHF Doherty amplifier circuit adapted to 830 MHz (channel 73) where such a circuit had not been used previously. Special circuits and components were required for the grounded grid UHF amplifier configurations to provide the Doherty amplifier performance; included were radial-mode input and output cavities for each of the two tubes in the final amplifier, a special input power divider circuitry, and a dynamic biasing arrangement. Over the range tested with a stair-step TV modulated signal, the Doherty amplifier provided from 13% to 58% greater plate efficiency, depending on signal

level, than an equivalent output Class B linear amplifier. For satellite operation where prime power is very costly, this improvement in efficiency is very advantageous. Author

N71-29220# Defense Documentation Center, Alexandria, Va.
RADAR AND RADAR DETECTION SYSTEMS: RADAR ANTENNAS, VOLUME 1 Report Bibliography, Feb. 1961–Aug. 1970
Mar. 1971 262 p refs
(AD-722200; DDC-TAS-70-82-1) Avail: NTIS CSCL 17/9

The bibliography contains selected annotated entries on Radar Antennas. These references pertain to antenna arrays, antenna radition patterns, antenna feeds, antenna components, types of radar antennas, and testing and evaluation of radar antennas. Computer-generated indexes cover corporate author-monitoring agency, subject, title, and personal author. Author (GRA)

N71-29323*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AM BASEBAND TELEMETRY TECHNIQUES
J. J. Clubb *In its* Instrumentation and Commun. Res. at MSFC, Vol. 4 May 1971 p 31–41 (See N71-29319 17-14)
Avail: NTIS CSCL 09F

Techniques and circuits used to design a highly flexible telemetry system are discussed. This single sideband/double sideband/constant bandwidth compatible system conforms to Inter-Range Instrumentation Group standards. The system has been tested for aerospace application where shock, vibration, or acoustic types of data must be efficiently processed. It meets requirements. Author

N71-29324*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH STABILITY FM TV TRANSMITTER WITH SAMPLED AUTOMATIC FREQUENCY CONTROL
M. A. Honnell *In its* Instrumentation and Commun. Res. at MSFC, Vol. 4 May 1971 p 43–50 refs (See N71-29319 17-14)
Avail: NTIS CSCL 17B

An S band frequency modulated television transmitter designed to drive a traveling-wave-tube amplifier is described. It provides an 18-MHz peak-to-peak deviation at video frequencies up to 10 MHz. A frequency stability of + or − 0.001 percent is achieved by alternately sampling the voltage-controlled oscillator signal during the backporch interval of the video signal and a crystal-controlled reference signal at intervals between the sync pulse. Author

N71-29326*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TELEVISION RESEARCH
C. T. Huggins *In its* Instrumentation and Commun. Res. at MSFC, Vol. 4 May 1971 p 57–65 refs (See N71-29319 17-14)
Avail: NTIS CSCL 17B

A solid state television camera that has no imaging tube and has characteristics of a vidicon camera with resolution greater than the home TV receiver is discussed. A brief theory of operation is given along with changes to the structure and improvements in the response characteristics during the last 4 years of development. The addressing problems and their solution for monolithic mosaics of greater than 50,000 phototransistors are discussed. A system for testing and evaluating the mosaics with 200,000 elements is described. An ultimate model projection of the solid state camera is given. Author

N71-29328# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhoffen, (West Germany). Inst. fuer Satellitenelektronik.
ON REDUNDANCY REDUCING SOURCE ENCODING [UEBER REDUNDANZREDUZIERENDE QUELLENCODIERUNG]
Hans Georg Musmann (Ph.D. Thesis–Brunswick Univ.) Nov. 1970 59 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-56) Avail: NTIS; ZLDI Munich: 15,40 DM

The codes for redundancy reduction are analyzed by methods of information theory. In order to achieve a uniform mathematical representation the codes are described by transformations and classified according to the structure of their transformations. For the individual classes the possibilities of coding are discussed and the optimum redundancy reduction factors are calculated. With regard to applications in synchronous PCM systems the new contributions of coding with constant word lengths are treated in detail. Author (ESRO)

N71-29360# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
TECHNIQUE FOR POSSIBILITIES EVALUATION OF SOME DEEP SPACE PROBES DATA COMPRESSION SYSTEMS
Y. C. Khodarev, V. P. Evdokimow, and V. M. Pokras 1970 26 p ref
(D-54) Avail: NTIS

The development of a technique for an apriori data compression ratio evaluation for a system of sensors in a telemetry frame is presented. An analysis is given of data compression variations for different service modes. Extreme values of the compression ratio for a varying amount of active channels are calculated, using their probability distribution. ESRO

N71-29361# Royal Aircraft Establishment, Farnborough (England).
NOMOGRAMS FOR THE CALCULATION OF MULTIPATH EFFECTS ON VHF AND UHF AIRCRAFT RADIO LINKS
G. May May 1970 28 p refs
(RAE-TR-70097) Copyright. Avail: NTIS

Expressions are derived for the difference in transmission times and the frequency of fading due to the multipath propagation of signals between two aircraft. Nomograms are presented both for the general and the simplified cases. The latter occur when approximations can be made because the sum of the heights of the two aircraft is much less than the distance between them. Author (ESRO)

N71-29362# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
DATA TRANSMISSION FOR PLANETARY STUDIES
Y. C. Hodarev 1969 29 p Presented at the 20th Congr. of the Intern. Astronautical Federation, Mar del Plata, Arg., 5–12 Oct. 1969
(D-6) Avail: NTIS

Possible ways of creating a system designed for data transmission from automatic surface vehicles on Mars and Venus are discussed. Two possibilities are proposed: relaying via an artificial planet satellite, or direct transmission to a ground station. A comparison of these modes is made for providing different scientific studies on the planet surface or in their atmosphere. ESRO

N71-29428# Naval Research Lab., Washington, D.C. Transducer Branch.
APPLICATION OF A SLOW WAVEGUIDE TO A FREE FLOODED RING TRANSDUCER
W. James Trott *In its* Rept. of NRL Progr., May 1971 May 1971 p 10–15 refs (See N71-29426 17-30)
Avail: NTIS

A free-flooded magnetostrictive ring transducer radiates approximately as sin square theta where theta is the direction relative to the ring axis. A slow waveguide in the form of a cylinder of silicone rubber is positioned on one side of the ring coaxial with the ring axis. The radiation then approximates a piston source with a significant increase in source level and directivity index. Author

N71-29438# Royal Aircraft Establishment, Farnborough (England).
THE CALCULATION OF THE DIVERGENCE FACTOR CHARACTERISTIC OF EARTH REFLECTED SIGNALS ON AIR-TO-AIR RADIO LINKS
G. May Nov. 1970 19 p refs
(RAE-TR-70210) Copyright. Avail: NTIS

An exact cubic equation is derived for locating the reflection point that occurs due to multipath propagation between two aircraft, so that the divergence factor for the reflected radiation can be calculated. It is shown that when the ratio of the heights of the two aircraft is large, approximations can be made leading to a quadratic equation. Two examples of divergence factor calculations are given using nomographic techniques for determining and checking the reflection point position. Possible extensions of these techniques to other aircraft height ratio cases are indicated.
Author (ESRO)

N71-29439# Royal Aircraft Establishment, Farnborough (England).
CIRCULAR ORBIT PATTERNS PROVIDING CONTINUOUS WHOLE EARTH COVERAGE
J. G. Walker Nov. 1970 72 p refs
(RAE-TR-70211) Copyright. Avail: NTIS

A study has been made of circular orbit patterns which ensure that every point on the earth's surface can always see at least one satellite (or two satellites for double coverage) above some minimum elevation angle. It is shown that five or six high altitude satellites can provide single coverage, and seven or nine satellites double coverage, at elevation angles which represent a significant improvement over previously published values. A generalized approach to such coverage assessments is presented.
Author (ESRO)

N71-29533# Eidgenossische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hochfrequenztechnik.
RAPID DATA TRANSMISSION IN CHANNELS WITH HIGH FREQUENCY SHIFTS [SCHNELLE DATENUEBERTRAGUNG IN KANAELEN MIT GROSSEN FREQUENZVERWERFUNG]
Felix Daniel Tisi (Ph.D. Thesis) 1970 129 p refs In GERMAN; ENGLISH summary
(Diss-4349) Avail: NTIS

A high speed data transmission system is treated in which the clock and the carrier oscillator in the receiver are synchronized in a new manner for coherent and synchronous reception over the telephone network as well as over radio links. With the employed orthogonal modulation the obtained transmission speed comes very close to the theoretical maximum of 2 bit/s Hz. No pilot signals are necessary because the synchronization signals are deduced from the transmitted data signal itself. This fact makes the system especially well suited for transmission channels with considerable frequency offset. The necessary control loops may almost entirely be realized in digital technique. The theory and the properties of the control loops are described in detail. It is shown how most parts of the system can be simulated on a digital computer. The measured properties are in good agreement with the theory and with the results of the computer simulation.
Author

N71-29536# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
GROUPING METHODS IN DATA COMPRESSION SYSTEM
V. I. Berezin and M. V. Nazarov [1969] 18 p
(D-62) Avail: NTIS

A method of redundant data reduction due to the sensor grouping based on the principle of causal interrelations of physico-chemical phenomena in space is proposed. It is shown that the known methods of data redundancy reduction have significant disadvantages sharply lowering their efficiency. Some equations of interplanetary and near-planetary spaces are considered that confirm causal interrelations of phenomena in space.
ESRO

N71-29551# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
THIRD-ORDER-TWO SIGNAL INTERMODULATION PRODUCTS FOR 242 FREQUENCIES BETWEEN 225–400 MHz
John M. Morrow (IIT Research Inst., Annapolis, Md.) Nov. 1970 98 p Prepared for FAA, Washington, D.C.
(Contract F19628-70-C-0291)
(ECAC-PR-70-018) Avail: NTIS

A series of reports are presented which are designed as handbooks to be used in FAA frequency assignment processes. Their sole purpose is to identify third order-two signal intermodulation products and their contributing frequency pairs. These matrices include all third order-two signal intermodulation products within the 118–136 MHz and 225–400 MHz band produced by mixtures of all possible pairs of selected channels. These products are of the form 2F1 - F2 and 2F2 - F1.
Author

N71-29552# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
THIRD ORDER-TWO SIGNAL INTERMODULATION PRODUCTS, 118–136 MHz: 50 kHz CHANNEL SPACING INDEXED BY INTERMODULATION PRODUCT
John M. Morrow (IIT Research Inst., Annapolis, Md.) Nov. 1970 125 p Prepared for FAA, Washington, D.C.
(Contract F19628-70-C-0291)
(ECAC-PR-70-016) Avail: NTIS
For abstract see N71-29551.

N71-29553# Department of Trade and Industry, London (England). Telecommunications Engineering Headquarters.
MOVEMENT OF EMERGENCY VEHICLES IN REDUCED VISIBILITY CONDITIONS. REPORT ON ASMI/TRANSPONDER TRIALS AT HEATHROW AIRPORT, SEPTEMBER 1970
A. R. Hillier and A. P. Fuggle 1970 28 p *its* Tels R3A Note 2/70, Issue 1
Avail: NTIS

The ASMI/Transponder tests for moving emergency service vehicles on airfields during poor visibility conditions are evaluated. The transponder was tested on a Nubian fire tender. Signals from the ASMI were used to interrogate the transponder at C band, and by transmission of the ASMI ppi picture to the vehicle via the microwave link. It is concluded that the simplest and cheapest arrangement is the provision of transponders on selected vehicles, and requires continuous guidance information to the vehicle by ATC. Transponder cover from all areas of the airfield could be provided.
F.O.S.

N71-29554# Electromagnetic Compatibility Analysis Center, Annapolis, Md. Federal Aviation Agency, Washington, D.C.
THIRD ORDER TWO SIGNAL INTERMODULATION PRODUCTS, 118–136 MHZ: 50 KHZ CHANNEL SPACING INDEXED BY CONTRIBUTING FREQUENCIES
John M. Morrow (IIT Res. Inst.) Nov. 1970 138 p Prepared for FAA
(Contract F19628-70-C-0291)
(ECAC-PR-70-015) Avail: NTIS
For abstract see N71-29551.

N71-29555# Environmental Science Services Administration, Boulder, Colo.
MODULATION CHARACTERISTICS CRITICAL TO FREQUENCY PLANNING FOR THE AERONAUTICAL SERVICES
R. W. Hubbard, D. V. Glen, and W. J. Hartman Apr. 1970 191 p refs
(Contract FA-67-WAI-134)

(ESSA-TM-ERL-ITS-232) Avail: NTIS

The fundamental characteristics of basic analog and digital modulation processes used in the Air Traffic Control (ATC) communication system are summarized. These characteristics have been condensed into a format in which they may be readily applied to the spectrum planning phases of ATC system design. Single channel modes of transmission are primarily considered for voice and data signals, but many of the aspects considered are also useful in describing the baseband signal structure for multichannel systems in which multiplex transmission modes are used. The purpose is to provide a basic set of signal descriptors and characteristics at several stages in a total ATC communication circuit. The tabulated characteristics may be applied systematically to help determine the initial channel spacing, allocation, and power requirements for a particular system in a given frequency band. Author

N71-29658# Florida Univ., Gainesville. Communication Sciences Lab.

SPEECH INTELLIGIBILITY AS A FUNCTION OF AMBIENT PRESSURE AND He02 ATMOSPHERE

Harry Hollien and Howard Rothman 15 Feb. 1971 15 p refs

(Contract N00014-68-A-0173-0008)

(AD-722371; CSL/ONR-18) Avail: NTIS CSCL 17/2

Speech intelligibility was obtained on Navy divers at sea level (in air) and at 200, 450 and 600 feet in helium-oxygen breathing mixtures. A total of 46 diver/talkers were studied (28 at 0 and 200 feet, 22 at 0 and 450 feet, and nine at 0 and 600 feet). Listeners were 15 University of Florida students trained for tasks of this nature. The combined effects of He02 mixtures and high ambient pressures were extremely detrimental to speech intelligibility which was reduced by approximately 50% for each increase of 200 feet of depth. Author (GRA)

N71-29783# Technische Univ., Berlin (West Germany). Fakultaet fuer Elektrotechnik.

SCANNING SYSTEMS FOR DATA CHANNEL EQUALIZATION [ABTASTSYSTEME ZUR ENTZERRUNG VON DATENKANAELEN]

Broder Wendland (Ph.D. Thesis) 1969 80 p refs In GERMAN

Avail: NTIS

Linear distortions in real transmission channels produce impulse interference frequencies during rapid data transmission resulting in a limited transmission rate velocity. Studied is the possibility of using echo equalizers to transfer linear low passages between the entrance of the transmission modulator and the output of the receiver modulator into ideal pulse systems. A nonlinear equalizer is used to modify distortions in channels of quantitized signal transmissions. A quantitized adaptable equalizer with feedback provides in about 0.8 sec equalization of rapid data transmission in telephone channels as well as continuous optimal equalization for slowly fluctuating channel parameters. Transl. by G.G.

N71-29817# Aerospace Corp., San Bernadino, Calif. Technology Div.

THE EFFECTS OF TAPE RECORDER EQUALIZATION TECHNIQUES ON ATTAINABLE BIT ERROR PROBABILITY

L. Peterson Los Angeles AF Sta. SAMSO Feb. 1971 12 p refs

(Contract F04701-70-C-0059)

(AD-722431; TR-0059(S6816-38)-3; SAMSO-TR-71-81) Avail: NTIS CSCL 14/3

The effects of tape recorder equalization techniques on digital communication are analyzed. The principal performance indicator is attainable bit error probability. A very general linear analytical model is presented and analyzed by conventional whitening filter techniques. An asymptotic predetection recording PCM/FM case is analyzed. The results show a clear superiority of prerecord equalization over the conventional post record equalization method. Author (GRA)

N71-29818 National Lending Library for Science and Technology, Boston Spa (England).

THE INFLUENCE OF SHARPNESS, GRADATION AND NOISE ON THE QUALITY OF THE TELEVISION PICTURE

J. Pazderak 19 Jan. 1971 24 p refs Transl. into ENGLISH from Rozhlasova a Televisni Tech. (Poland), v. 11, no. 1, 1970 p 14–24

(NLL-PORS-TRANS-2725-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The existing criteria of television picture quality are discussed and actual methods are described for investigating the influence of the basic qualitative parameters of sharpness, gradation, and noise. A study was conducted to determine the individual and simultaneous effects of these parameters on picture quality. The results obtained are presented along with descriptions of the experimental equipment used. Author

N71-29844 National Lending Library for Science and Technology, Boston Spa (England).

DELTA CODING DEVICE

J. Y. Queffeulou 19 Jan. 1971 22 p Transl. into ENGLISH from L'echo Des Rech. (France), no. 57, Jul. 1969 p 30–40

(NLL-PORS-2687-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The principle of delta modulation is briefly reviewed and various methods for improved performance are examined. A number of practical implementations are described and a discussion is given of their main results. Author

N71-29846*# National Aeronautics and Space Administration. Ames Research Center, Moffet Field, Calif.

EFFECT OF OSCILLATOR INSTABILITY ON TELEMETRY SIGNALS

Terry L. Grant and Randolph L. Cramer Washington Jul. 1971 46 p refs

(NASA-TN-D-6442; A-3836) Avail: NTIS CSCL 09F

Short-term oscillator instability and its effect on telemetry signals are discussed. Instability measurements are related to the total phase jitter expected in a telemetry receiver and the resulting degradation of telemetry performance. The analysis of phase jitter present in the telemetry system of Pioneer 6 through 9 serves as an example. The instability is described by the measurement of oscillator phase jitter, and the function and operation of the measuring instrument are explained. Author

N71-29847# ITT Defense Communications Div., Nutley, N.J.

C-BAND CONVERSION OF MANPACK RADIO

Charles Greenwald, Peter Torrione, and James Irvine Griffiss AFB RADC Apr. 1971 88 p

(Contract F30602-70-C-0017)

(AD-722737; RADC-TR-71-65) Avail: NTIS CSCL 17/2

The report covers the fabrication and integration of C band modules which are mechanically and electrically inter-changeable with the X Band modules in the Manpack Radio to provide operation in the 4.4 to 5.0 Ghz band. Both C and X Band operations are possible by inserting the appropriate modules. Author (GRA)

N71-29898# Picatinny Arsenal, Dover, N.J.

THE PICATINNY ARSENAL AUTOMATED ANTENNA CHECKOUT STATION

M. Rosenbluth 19 p ref

(AD-723055; PA-TM-1995) Avail: NTIS CSCL 9/6

The Telemetry Division of the Technical Services Directorate has instrumented a modern Antenna Checkout Station on a 200-foot by 500-foot tract of land at Picatinny Arsenal. A positioner was installed, capable of handling full-scale missiles or large antennas having maximum length of 25 feet, maximum dia. of 50 inches, and whose weight can be as large as 2,500 pounds. The ACS

instrumentation operates in L and S-Band. Frequency extension to cover 200 MHz to 18 GHz is presently in progress. The ACS has been instrumented to provide the following measurements: (a) Radiation density plots over a full sphere with printout level suppression; (b) Polarization plots over a full sphere; (c) Amplitude and phase of near field distribution; (d) Phase center location for an antenna. Processing of these measurements will be carried out in the Picatinny Arsenal CDC 6500 computer. Author (GRA)

N71-29912 Brown Univ., Providence, R.I.
ATTENUATION OF MICROWAVE FREQUENCY COMPRESSIONAL WAVES IN ALUMINUM OXIDE AND RUBY AT LOW TEMPERATURES
Stuart Livingstone McBride (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms Order No. 70-8762

The temperature dependent part of the attenuation of compressional waves propagating along the c-axis of aluminum oxide and ruby was measured at frequencies of 400 MHz, 1.23 GHz, 2.32 GHz, and 2.94 GHz in the temperature range of 10 to 100 K. The ruby samples contained 0.025, 0.08, 0.2, and 0.9% chromium by weight respectively. In undoped aluminum oxide, in the temperature range of 40 to 50 K, the attenuation is frequency independent and varies as T to the 9th power. At higher temperatures, the attenuation is frequency dependent and varies less rapidly with temperature. With increasing chromium content, the attenuation in ruby increases at low temperatures and decreases at high temperatures. These measurements are explained by the interaction of the compressional wave with the thermal phonons. It is shown, using the measured second and third order elastic constants, that the interaction with longitudinal phonons cannot account for the observed attenuation. Dissert. Abstr.

N71-29916# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES
B. I. Rapoport et al 28 Jan. 1971 22 p refs Transl. into ENGLISH from Tekhnika Kino i Televideniya (USSR), no. 6, 1970 p 51–57
(AD-722308; FTD-MT-24-297-70) Avail: NTIS CSCL 17/2

Discussed are possibilities of designing a holographic television system. Given are experimental test results of the system during the long image duration and also the prospects of using special television systems with the tracking scanning for contour image transmission. Author (GRA)

N71-30050# Naval Weapons Center, China Lake, Calif.
VLF-PROPAGATION MEASUREMENT TECHNIQUE USING REPETITIVE PULSE SPECTRAL LINES
Verne E. Hildebrand and Donald J. Adrian Feb. 1971 40 p refs
(AD-722703; NWC-TP-5038) Avail: NTIS CSCL 20/14

A concept is presented which utilizes the spectral sidebands of VLF repetitive-pulse transmission to greatly increase the number of frequencies available for VLF sounder measurements. A theoretical analysis of the concept is developed, the prototype equipment is described, and samples of VLF sounder data acquired in the initial field-test evaluation are given. Author (GRA)

N71-30073 National Lending Library for Science and Technology, Boston Spa (England).
PCM IN RADIO RELAY TRANSMISSION
Z. Radic 19 Jan. 1971 15 p refs Transl. into ENGLISH from Elektrotekhnika (USSR), no. 2, 1969 p 112–118
(NLL-PORS-2703-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The advantages and prospects of pulse code modulation in radio relay transmission were analyzed. The principle of solutions for multichannel systems and modulation and detection methods are discussed. A short survey of special semiconductor components in the microwave region is presented and some essential advantages of the pulse code modulation in radio relay transmission over other systems are included. Author

N71-30181 National Lending Library for Science and Technology, Boston Spa (England).
A METHOD OF DESIGNING VESTIGIAL SIDEBAND FORMING BAND-PASS FILTER
T. Takebe et al 19 Jan. 1971 10 p refs Transl. into ENGLISH from Kanazawa Daigaku Kogakubu Kiyo (Japan), no. 5, 1969 p 133–138
(NLL-PORS-2682-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is discussed for obtaining a bandpass transfer function, having little delay distortion in a vestigial sideband, by coupling bandpass transfer functions. The discussion is confined to a situation where the central angular frequency is located at the boundary between the vestigial sideband and a single sideband, the vestigial sideband being located below the central angular frequency, and the overall bandwidth being narrow. Symmetrical bandpass characteristics are formed by separately combining the amplitude characteristics above and below the central angular frequency with an image in respect of the frequency. If the characteristic on the lower side is of the cosine-cubed form, the phase characteristic accompanying this in a minimum phase transition type circuit has a high linearity. These two characteristics are approximated by transfer functions derived separately from suitable low-pass-type transfer functions by band frequency conversion. Author

N71-30235# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
EFFECTS OF WEATHER Final Report
2 Mar. 1971 11 p refs
(AD-723029; MTP-6-3-509) Avail: NTIS CSCL 17/2

Procedures are prescribed for the service test of communication-electronic equipment under adverse weather conditions to the extent that such conditions prevail at test locations. Author (GRA)

N71-30242# Georgia Inst. of Tech., Atlanta. Electronics Div.
SHAPING ANTENNA PHASE AND AMPLITUDE DISTRIBUTIONS FOR LOW SIDELOBES Final Report, 1 Feb. 1970–31 Jan. 1971
Charles P. Burns, H. Allen Ecker, and Edward S. Joy 28 Feb. 1971 105 p refs
(Contract F19628-70-C-0169)
(AD-722718; AFCRL-71-0180) Avail: NTIS CSCL 20/14

For many radar applications, extremely low antenna sidelobes can improve system performance. Current techniques utilize only the antenna amplitude distribution to produce lower sidelobes. This report presents results of an investigation of combined amplitude and phase tapering to produce lower sidelobes. Combinations of phase and amplitude distributions and the resulting far-field patterns were studied theoretically through computer analysis. Gaussian phase tapers with cosine and modified Taylor amplitude distributions were studied in detail. Experimental work included the construction of a dielectric lens for a horn antenna that significantly lowered the sidelobe level. Design information was compiled to demonstrate tradeoffs between amplitude tapering alone and combined phase and amplitude tapering. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-29264# Bureau of Mines, Washington, D.C.
A GENERAL COMPUTER PROGRAM FOR USE IN THE REDUCTION OF BURNETT COMPRESSIBILITY DATA
B. J. Dalton, R. Leroy Moffitt, Robert E. Barieau, and D. R. Smith 1970 282 p refs
(BM-IC-8491) Avail: SOD $2.50

The program includes important modifications and extensions of some of the methods currently used for treating Burnett compressibility data and yields statistical information that cannot be obtained from any other published work. The methods of calculation makes use of a general nonlinear least squares technique. Because of a need to investigate different functional forms for representing the compressibility factor isotherm, Z, the computer program has been written in such a way that the only additional coding required is the so-called compressibility function subroutine. This subroutine defines the analytical form of Z and certain of its partial derivatives. The program is believed to be the most advantageous for use in treating isothermal Burnett compressibility data. Author

N71-29301# Joint Publications Research Service, Washington, D.C.
TWO STUDIES ON DIGITAL COMPUTERS
18 Jun. 1971 8 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 14, no. 3, 1971 p 54-57 and 111
(JPRS-53399) Avail: NTIS

CONTENTS:
1. THE STRUCTURE OF DIGITAL COMPUTERS V. B. Smolov et al p 1-2 ref (See N71-29302 17-08)
2. PULSE-POTENTIAL SWITCH FOR COMPUTER MEMORIES L. K. Samoylov et al p 3-6 (See N71-29303 17-08)

N71-29302# Joint Publications Research Service, Washington, D.C.
THE STRUCTURE OF DIGITAL COMPUTERS
V. B. Smolov et al *In its* Two Studies on Digital Computers 18 Jun. 1971 p 1-2 ref (See N71-29301 17-08)
Avail: NTIS

A book review is presented on digital computers as complex heuristic systems. A multilevel description of digital computer structure and function was used to eliminate a programming language evaluation. Microprogramming terminology, diagrams, and time sharing are briefly cited. J.A.M.

N71-29303# Joint Publications Research Service, Washington, D.C.
PULSE-POTENTIAL SWITCH FOR COMPUTER MEMORIES
L. K. Samoylov et al *In its* Two Studies on Digital Computers 8 Jun. 1971 p 3-6 (See N71-29301 17-08)
Avail: NTIS

A switching circuit is described that allows maximum use of memory-unit assemblies. Processes are analyzed, and design equations and experimental results are presented. Author

N71-29322*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INVESTIGATION OF DATA COMPRESSION TECHNIQUES
W. E. Maynard *In its* Instrumentation and Commun. Res. at MSFC, Vol. 4 May 1971 p 19-30 refs (See N71-29319 17-14)
Avail: NTIS CSCL 09B

Because of the highly redundant nature of space flight data, compression techniques were investigated using the Telemetry Redundancy Analyzer. The results of a study of five different data compression techniques are presented. The performance of each technique was analyzed for input data models consisting of three known deterministic signals. The basic operation of each technique was established, and some knowledge of their relative effectiveness was determined. Author

N71-29329# Norwegian Computing Center, Oslo (Norway).
A 2 BY K CONTINGENCY TABLE CALCULATION OF PROBABILITIES USING FORTRAN SUBROUTINE
J. Martin Apr. 1969 6 p
Avail: NTIS

T sub o is an observed 2 x k contingency table, P(T sub o) is the probability of T sub o for given marginals under H sub o. P(T sub i) is the probability under H sub o of the set of tables having the same marginal totals. The hypothesis H sub o is rejected if a defined critical level is equal to or below the preassigned significance level. ESRO

N71-29440# Norwegian Computing Center, Oslo (Norway).
IMPLEMENTATION OF DEFINED PARTS OF UNIVAC 1107/1108 SIMULA 67: PRELIMINARY SPECIFICATION
Bjoern Myhrhaug [1970] 21 p
Avail: NTIS

An operating system program, SIMULA 67, is described, which permits chaining of any number of programs, and using parts of existing languages, such as COBOL and ALGOL. The individual program features are described, including input and output procedures. ESRO

N71-29441# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
USE OF THE ONBOARD COMPUTER FOR SPACECRAFT PROGRAM-TIME CONTROL
L. N. Lupichev and I. V. Shamanov 1969 15 p Presented at the 8th Intern. Symp. on Space Sci. and Technol., Tokyo, 25-30 Aug. 1969
(D-0002) Avail: NTIS

To fulfil the elemental time program for controlling the spacecraft onboard equipment specialized automata are used. For cases when the problems to be carried out by the spacecraft become more complicated, the use of an onboard computer is suggested. The feasibility of such a solution is investigated. ESRO

N71-29442# Royal Aircraft Establishment, Farnborough (England).
RELIABILITY IMPROVEMENT BY REDUNDANCY IN ELECTRONIC SYSTEMS. 2: AN EFFICIENT NEW REDUNDANCY SCHEME: RADIAL LOGIC
Theresa F. Klaschka Mar. 1969 69 p refs
(RAE-TR-69045) Copyright. Avail: NTIS

An efficient new redundancy scheme called radial logic, which is suitable for binary logic circuitry, is described. Rules for applying radial logic are given, together with rules for achieving satisfactory interfaces with subsystems which are unredundant or have another form of redundancy. The mechanism of error correction in radial logic is analyzed, and a general expression for the reliability improvement it produces is derived. Methods of testing redundant systems are also discussed. Radial logic is shown to be very efficient in terms of the reliability improvement produced for the amount of redundancy used. The degree of error correction achieved is flexible, the scheme is relatively simple to apply, and standard circuits can be used. Author (ESRO)

N71-29559# Human Engineering Labs., Aberdeen Proving Ground, Md.
WORD RECALL AND CLUSTERING AS A FUNCTION OF DELAY INTERVAL, LIST TYPE AND SORTING TECHNIQUE
Dennis F. Fisher May 1970 53 p refs
(AD-708560; TM-12-70) Avail: NTIS

An experiment to test the hypothesis that amount recalled and clustering, occurrence of related words in strings of two or more, are inversely related to the delayed recall interval is described. The experimental manipulations employed were list type - categorized and random, card sorting technique - free or constrained, and delay interval - 1 hr., 2 hr., 5 hr., 24 hr., and one week. The results indicated that the amount recalled and number of clusters recalled decreased with increases in the delay interval. However,

word frequency, degree of clustering and cluster size were not affected. List type was found to be the most important determiner of performance. The categorized list group recalled more words, had the greatest degree of clustering and formed larger clusters than the random list group. The card sorting task was a modification of Mandler and Pearlstone (1966). The free-sort group recalled more words and used more clusters than the constrained-sort group. The constrained-sort group formed larger clusters than the free-sort group. Sorting technique was not seen as a factor in determining the degree of clustering. Author

N71-29670 California Univ., Los Angeles.
LOW LEVEL SELF-MEASUREMENT IN COMPUTERS
Robert Alfred Koster (Ph.D. Thesis) 1969 178 p
Avail: Univ. Microfilms Order No. 70-14296

Tools are described that were developed for low level self-measurement, requiring no special hardware. Suggestions for features that could be incorporated into standard machines to make self-measurement easier or less expensive and for special measurement hardware are given. One tool is an efficient self-simulator that closely duplicates the operation of the machine it is running on. It can be probed at the sub-instruction level by a data collection routine to determine detailed characteristics of the programs running on it. Simulators for the IBM 360 and the SDS Sigma-7 computers and a set of data collection routines for these simulators are described. The other tools are implementations of algorithms for making high precision measurements of the time duration of events or activities in a computer. Dissert. Abstr.

N71-29883*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ONBOARD SPACECRAFT OPTICAL DATA PROCESSING
A. S. Husain-Abidi Jun. 1971 22 p Presented at NASA and Opt. Soc. Am. Conf. on Holography and Opt. Filtering, Huntsville, Ala.
(NASA-TM-X-65603; X-711-71-259) Avail: NTIS CSCL 14C

The use of hybrid optical-digital systems for use on Earth Resources and Planetary spacecraft is explored. Attributed an onboard spacecraft optical system must possess low power, ruggedness and absence of mechanical or photographic links. With onboard satellite use in mind, a unique system has been designed. The main features of the system are the use of off-axis parabolic mirror segments as collimating Fourier transforming and image reconstructing elements, and a gallium arsenside laser diode as a point source of coherent electromagnetic radiation. Performance of this system for generating Fourier transform relationship and spatial filtering are very encouraging. Author

N71-29894*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MULTICLASS SEQUENTIAL HYPOTHESIS TEST WITH APPLICATIONS IN PATTERN RECOGNITION
Jung Pyo Hong 15 Jun. 1971 120 p refs
(Contract NAS7-100)
(NASA-CR-118989; JPL-TM-33-482) Avail: NTIS CSCL 06D

The sequential multiclass hypothesis test presented allows rapid computation of the errors of the first and second kinds for each possible decision. One interpretation of this test is that it computes the ratio of the likelihood of an observation coming from a class to the likelihood of an observation coming from any other class. When this ratio exceeds a threshold a decision in favor of the class is made. For each sample, there are as many such comparisons as there are classes. The sequential multiclass hypothesis test proposed is a Bayes test for each step. The proposed test is Wald's sequential probability ratio test for the two-class problem. Extensive experiments with block letters and handwritten numerals are reported. These experiments verify the usefulness of the proposed multiclass hypothesis test. These experiments show that the error rates are under the control of the user and that the average length of the test can be predicted. A survey of the methods in pattern recognition is presented. Author

N71-30013*# Stockholm Univ. (Sweden). Inst. of Physics.
HARDWARE SYSTEM FOR MEASUREMENTS OF BUBBLE CHAMBER FILMS ON-LINE
G. Blomqvist, S. O. Holmgren, P. O. Hulth, and U. Svedin Jun. 1970 48 p refs
(USIP-70-3) Avail: AEC Depository Libraries

A hardware system was constructed to connect a measuring device for bubble chamber films, on-line, to a CDC 8090 computer. An earlier off-line system is compared. The device consists of an operator's console with thumbwheel switches, label displays, signal lights, and counting equipment all connected via the interface to the computer. Measurement procedures and the dynamical function of the interface are provided, as well as details of the equipment. NSA

N71-30025*# Technische Hochschule, Darmstadt (West Germany).
MAGNETIC CORES FOR ANALOG STORAGE [MAGNETKERNE ALS ANALOGSPEICHER]
Hans-Peter Kahl (Ph.D. Thesis) 1969 79 p refs In GERMAN
Avail: NTIS

Mathematical models are used to calculate analog memory lines of ferromagnetic core elements that reduce printing and reading times and possess increased storage capacities. Mathematical models are used for optimizing the selection system parameters of: linearity between entering and outgoing values, cycle time, temperature dependence, and for developing multiple cell memories in a matrix arrangement. The transfluxor element evolved as the best possible memory for an analog storage core. Transl. by G.G.

N71-30030*# National Bureau of Standards, Washington, D.C. Cryogenics Div.
CORRECTIONS AND CALCULATIONS ON AN X-RAY DIFFRACTION LINE PROFILE: A COMPUTER PROGRAM
Raymond E. Schramm Jun. 1971 35 p refs
(NBS-TN-600) Avail: SOD $0.40

A computer program to perform corrections and make calculations on an X-ray diffraction profile before Fourier analysis is presented. The corrections are for background and for variations of intensity with the Bragg angle. Also calculated are the separation of the K alpha sub 1 - K alpha sub 2 doublet and the centroid and position of peak maximum with their standard deviations. There is also an option to smooth the profile. Author

N71-30086*# Martin Marietta Corp., Denver, Colo. Electronics Research Dept.
FORMULATION OF A TELEMETRY COMPUTER PROGRAM, SUPPLEMENT 2 Final Report
Keith H. Hill, Robert O. Leighou, and Duane L. Starner May 1971 85 p refs
(Contract NAS8-24017)
(NASA-CR-119850; MCR-70-38-Suppl-2) Avail: NTIS CSCL 09B

The algorithm described is a fast algorithm for the simultaneous minimization of multiple Boolean functions to a two-level AND-OR form. The major advantages of the algorithm are that it is fast, does not require excessive storage capacity, handles multiple functions, and utilizes unused input states (don't cares) for simplifying the functions. The program as written handles up to 16 variables with no limit to the number of functions; however, the resultant total number of prime implicants may not exceed 3073. This algorithm thus provides the capability for minimizing a set of functions of a large number of variables which were previously done poorly by manual methods and could not be done by computer because of excessive time and storage requirements. Author

N71-30108*# Maryland Univ., College Park. Computer Science Center.
FORMAL SYSTEM: TECHNICAL DOCUMENTATION
Charles K. Mesztenyi Sep. 1970 468 p Prepared for JPL
(Grant NGL-21-002-008; Contract JPL-952695)

(NASA-CR-119188) Avail: NTIS HC $6.00/MF $0.95 CSCL 09B

The FORMAL language, an extension of FORTRAN 5, is described. It provides the user with the capability of performing symbolic algebraic manipulation, and is also available as an interactive symbolic manipulator. The technical documentation, including program listings, of FORMAL for the Univac 1108 computer is presented. Author

N71-30148# Robot Research, Inc., San Diego, Calif.
NETWORK PROPERTIES FOR PATTERN RECOGNITION Final Report, 1 Apr. 1968 – 31 Mar. 1971
J. K. Hawkins 31 Mar. 1971 50 p refs
(Contract N00014-68-C-0315)
(AD-722697; RR-7102) Avail: NTIS CSCL 9/2

The report describes research conducted on the fundamental properties required of networks for automatically extracting information from complex pictorial scenes. The investigation was divided into two parts: Physical properties needed by material structures in order to process data; Mathematical properties needed by networks to extract the types of patterns occurring in pictorial data such as aerial photographs. Author (GRA)

N71-30147# Institute of Technology, Helsinki (Finland). Dept. of Technical Physics.
IRESINT 2: A FORTRAN PROGRAM FOR CALCULATION OF RESONANCE INTEGRALS
Frej Wasastjerna 31 Dec. 1970 46 p refs
(TKK-F-A-139) Avail: AEC Depository Libraries

The IBM S/360 FORTRAN 4 G program IRESINT 2 is described. The program computes heterogeneous resonance integrals for both fissile and non-fissile nuclides, and for resolved and unresolved resonances. The resolved resonances are computed according to the intermediate resonance approximation with or without interference scattering. The geometry has to be a square or hexagonal lattice of cylindrical fuel rods. Author (NSA)

N71-30163 National Lending Library for Science and Technology, Boston Spa (England).
A MACHINE ALGORITHM FOR ESTABLISHING DERIVABILITY BY THE INVERSE METHOD [MASHINNYI ALGORIFM USTANOVLENIYA VYVODIMOSTI NA OSNOVE OBRATNOGO METODA]
G. V. Davydov et al Oct. 1970 14 p refs Transl. into ENGLISH from Zap. Nauch. Seminarov. Lenin. Otdel Mat. Inst. Im Steklova. A.N. (SSSR), v. 16, 1969 p 7–19
(NLL-RTS-5856) Avail: Natl. Lending Library, Boston Spa, Engl.: 26s Od, 4 NLL photocopy coupons

A short description is given of an algorithm for establishing derivability in classical predicate calculus with functional signs. An inverse method is used as the logical basis of the algorithm. Initial formulae and F-sets, operation with closed sets, permutations and glueing of sets, and use of decomposable sets are discussed. A.C.R.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-29229# Radio Corp. of America, Princeton, N.J. RCA Labs.
SOLID STATE PULSE MODULATORS Final Report
J. F. Reynolds Mar. 1971 31 p Prepared for Sandia Labs.
(SC-CR-70-6157) Avail: NTIS

A program aimed at developing solid state pulse modulators for use with two-terminal semiconductor microwave sources with particular emphasis on avalanche diodes is described. Two initial modulators capable of working with single or series stacked avalanche diodes with a total breakdown voltage of 300 volts were developed. The final units were optimized for operation with avalanche diodes working in the high efficency (TRAPATT) mode. The efficiency of these modulators was between 80% and 90%. Author (NSA)

N71-29298# California Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL SOLUTION OF TWO-LINE TRANSMISSION LINES WITH TIME-DEPENDENT SERIES RESISTANCE AND SHUNT CONDUCTANCE AND WITH A PRESCRIBED CHARGE DEPOSITION RATE
Kane S. Yee 5 Jan. 1971 15 p Sponsored by AEC
(UCRL-50991) Avail: NTIS

A two-line transmission line terminated at both ends by resistors is investigated to see how the signal depends on the line's shunt conductance and the termination. The approach used is a combination of the leap frog scheme and the method of characteristics. A numerical scheme is presented along with the computer code used and some analysis of the transmission lines. The numerical calculation approximates the boundary conditions from the explicit solution of an idealized, lossless transmission line. The numerical scheme works very well for a smooth charge deposition. The code was used to find out what fractions of the energy are dissipated by various causes. Author

N71-29314# Royal Aircraft Establishment, Farnborough (England).
ENGINEERED DESIGNS FOR VERY WIDE BAND RADIO FREQUENCY TRANSFORMERS (BALUNS) USING PRINTED CIRCUIT STRIP LINE TECHNIQUES
D. P. L. May Apr. 1970 31 p refs
(RAE-TR-70063) Copyright. Avail: NTIS

Fully engineered designs for transformers with 50 ohm unbalanced primary and 25, 50, 75, 100, and 150 ohm secondary characteristics are given. Four types together cover the frequency range from 50 to 2000 mHz. Quick-design and testing information for the manufacture of units outside this range is included. Author (ESRO)

N71-29375# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
INVESTIGATION OF CHARACTERISTICS AND PRACTICAL IMPLEMENTATION OF ARBITRARILY POLARIZED RADIATORS IN SLOT ARRAY
Nam S. Wong, Raymond Tang, and George H. Okubo 1 Feb. 1971 111 p refs
(Contract F19628-70-C-0142)
(AD-722068; FR-71-14-139; AFCRL-71-0185; SR-1) Avail: NTIS CSCL 9/5

The feasibility of obtaining arbitrary polarization in both one and two dimensional slot arrays was established. The arbitrarily polarized radiating element consists of a pair of cross slots which are cut in the side wall of a bifurcated rectangular waveguide. Vertical and horizontal polarizations are excited by the sum and difference modes in the bifurcated waveguide respectively. By superimposing the sum and difference modes in the proper amplitude and phase, any arbitrary polarization can be synthesized. An excitation assembly which consists of two 3-dB broadwall couplers and a one-bit phase shifter in each half of the bifurcated waveguide can provide four polarizations: Vertical linear, horizontal linear, right and left handed circular polarizations. Experiments performed on this radiator indicates that the aperture distribution of an array of these cross slots has good phase quality for any arbitrary polarization. Furthermore, the polarization purity is also satisfactory. For example, measurements of an isolated cross slot show that the axial ratio

for the cross slot operating in a circular polarization mode is approximately 0.25 dB. The element pattern of the cross slot is well behaved. Author (GRA)

N71-29391# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
A 4 GHz PARAMETRIC AMPLIFIER WITH VERY LOW NOISE [AMPLIFICATEUR PARAMETRIQUE 4 GHz A TRES FAIBLE BRUIT]
Michel Ruppli [1970] 44 p refs In FRENCH Submitted for publication Sponsored in part by Direc. de Rech. et Moyens d'Essais
Avail: NTIS

The reception of satellite signals by ground stations requires low-noise amplifiers in the range from 3700 to 4200 MHz. A broadband parametric amplifier with a noise temperature less than 100 K has been designed and a theoretical analysis of it has been performed on an IBM 1130 computer. The bandwidth can be enlarged by using a twin-resonator signal circuit. ESRO

N71-29423# Radio Corp. of America, Princeton, N.J. Semiconductor Device Research Lab.
HIGH-PEAK-POWER, HIGH-EFFICIENCY AVALANCHE OSCILLATORS Final Report, 5 Nov. 1969 – 4 Nov. 1970
S. G. Liu Mar. 1971 58 p Prepared for Sandia Corp., Albuquerque, N. Mex. Sponsored by AEC
(SC-CR-70-6171) Avail: NTIS

Investigation of high-efficiency-mode diodes was conducted during period for high-peak-power, high-efficiency avalanche oscillators. Waveform and circuit impedance studies were also pursued. The high-efficiency mode of oscillation has been extended into the S-band, with pulsed power output of 110 W on a microstrip circuit. A compact L-band microstrip oscillator circuit has been developed. The circuit measures 1 in × 2 in. × 1/2 in and gives 130 W power output. High-duty cycle operation (up to 50%) of high-efficiency-mode diodes has been achieved in an operation of series-and -parallel connected diodes has been demonstrated. A study of harmonic extraction using microstrip circuits has led to useful sets of data relating the basic circuit parameters and the fundamental, second- and third-harmonic frequencies. Author

N71-29480# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
LINEAR ANTENNAS AND DIPOLE ARRAYS IN A DISSIPATIVE HALF-SPACE
Marvin Siegel Mar. 1971 107 p refs
(Contract N00014-67-A-0298-0005)
(AD-721706; TR-608) Avail: NTIS CSCL 9/5

The important practical problems of evaluating the electromagnetic fields of finite-sized antennas or of dipole arrays in a dissipative half-space (free-space above an ocean or free-space above a plane earth) are investigated. In this report (1) expressions for the fields of horizontal coplanar dipole arrays in a dissipative half-space are formulated, (2) integral expressions for the fields of horizontal linear antennas in a dissipative half-space are formulated (which can be easily evaluated numerically), and (3) a useful traveling-wave insulated antenna immersed in a dissipative half-space is examined. Author (GRA)

N71-29492# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
ESTERLINE ANGUS VOLTAGE AND FREQUENCY TRANSDUCER (MODEL S-21289) AND RECORDER (MODEL E-1102R) Interim Evaluation Report
David M. Presley Jan. 1971 25 p
(AD-721897; USAMERDC-1993) Avail: NTIS CSCL 14/2

The report describes the evaluation tests of the Esterline Angus Voltage Transducer Model S-21289 in conjunction with the Esterline Angus Galvanometer Recorder Model E-1102R. The tests and test procedures used are discussed briefly and the results are compared with the Performance Requirements for Recording Instruments set forth in a proposed revision to Military Handbook 705. Author (GRA)

N71-29493# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
THE DEVELOPMENT AND USE OF SCATTERING PARAMETERS FOR SEMICONDUCTOR JUNCTION DEVICES
L. D. Philipp and L. T. Boatwright Mar. 1971 198 p
(Contract N00014-68-A-0158)
(AD-722061; EE-183(71)ONR-005) Avail: NTIS CSCL 9/1

Scattering parameters are developed for diodes and transistors. The parameters are developed through a modification of the wave equation from quantum mechanics. The effects of pulsed X-ray radiation on these devices is then calculated with the use of these parameters. Various methods of analyzing semiconductor junction devices are discussed. These methods include diffusion theory, invariant imbedding and quantum mechanics. The background in these areas necessary for a discussion of semiconductor models is outlined. Models resulting from the three basic approaches are presented. These include the Ebers-Moll Model, the Sparks Charge Control Model, the Linville Model, the Gore Model, the MLB (McKelvey, Longini and Brody) Model and the Kronig-Penney Model. The importance of using the correct model in calculating the effects of ionizing radiation is emphasized. Small-signal models are introduced. It is shown that semiconductors can be modeled through quantum mechanics by introducing a new term into the Schrodinger Wave Equation. Author (GRA)

N71-29662 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE STABILITY OF A SYNCHRONIZED INDUCTION MOTOR WITH A PHASE COMPOUNDING SYSTEM, USING A DIGITAL COMPUTER [BADANIE STABILNOSCI INDUKCYJNEGO SILNIKA SYNCHRONIZOWANEGO Z KOMPAUNDACJA ZA POMOCA MASZYNY CYFROWEJ]
T. Kaczmarek Mar. 1971 15 p refs Transl. into ENGLISH from Arch. Elektrotech. (Warsaw), v. 19, no. 1, 1970 p 125–133
(NLL-RTS-6232) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.20; 4 NLL photocopy coupons

A method is presented whereby the stability of a synchronized induction motor with a phase compounding system can be investigated by means of a digital computer. The differential equations for defining the electrical and the mechanical equilibrium of the system are given. Based on the method of slight deviations, linearization of the equations is carried out and a characteristic equation for the system is deduced. An analysis of the stability is conducted on the basis of the Routh criterion, the printed results of which enable the nature of any eventual instability to be determined (i.e. self-excited oscillations or creep of the angular characteristic). The block schematic program for computation by the digital machine ODRA-1013 is given. Author

N71-29667# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH POWER ELECTRONICS
P. L. Kapitsa et al 27 Jan. 1971 417 p refs Transl. into ENGLISH from Sb. Elektron. Bolshikh Moshchnostey (USSR), v. 5, 1968 p 1–311
(AD-722279; FTD-HC-23-269-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 9/1

Linear theory of the orotron; The oscillating system of an orotron; The orotron as a generator in the millimeter range; The

open resonator used in a magnetic radiospectrometer; Research on open resonators with field concentrations; Experimental study of a barrel-shaped open resonator; An open resonator with an echellete lattice; Force oscillations of an open resonator connected to a wave guide; Aberrations in geometric optics of open resonators; Open resonators formed by parallel disks with an arbitrary ratio of their diameter to the distance between them; The space charge in crossed fields; Calculation of a solenoid with a uniform magnetic field; New converters of an H sub 10 wave; A dielectric plate as a high-frequency magnetic field concentrator in a cavity resonator; Measurement of the dielectric permeability of fused quartz specimens; Effective regimes for a microtron; Numerical calculation of the acceleration regimes in a microtron; The dynamics of particles in a microtron with a nonuniform magnetic field; Measurement of the magnetic field nonuniformity in a microtron with 30 orbits; Phase oscillations in a microtron with a large circuit and Measurements of the accelerating resonator of a microtron. GRA

N71-29731# Office of Naval Research, London (England).
TELECOMMUNICATIONS AT THE HIRST RESEARCH CENTER
Richard O. Rowlands 26 Mar. 1971 9 p refs
(AD-722331; ONRL-R-12-71) Avail: NTIS CSCL 9/5

The report describes some of the research being carried out at the Hirst Research Centre on filter design, computer aided circuit design and systems theory. Author (GRA)

N71-29732# Naval Underwater Systems Center, New London, Conn.
THE OPEN CIRCUIT SENSITIVITY OF RADIALLY POLARIZED FERROELECTRIC CERAMIC HOLLOW SPHERES
Charles L. LeBlanc 14 Dec. 1970 36 p refs
(AD-722401; NUSC/NL-3030) Avail: NTIS CSCL 9/1

The open-circuit sensitivities of radially polarized ferroelectric ceramic spheres are derived from the viewpoint of treating the ceramic as an anisotropic material. The results are in good agreement with similar sensitivities predicted on the basis of isotropic stress distributions. Graphs of the open-circuit sensitivity versus the ratio of wall thickness to outside diameter for several different ceramic materials indicate the region over which the spherical elements may be considered to be thin-walled spheres. Included for comparison are the sensitivities of similar ceramic spheres that are not pressure-released on the inside surface but are in immediate contact with a solid sphere. Also included are graphs of the magnitude of the stresses induced in the spheres by the ambient hydrostatic pressures. Author (GRA)

N71-29741# Mississippi Univ., University. Dept. of Electrical Engineering.
SCATTERING MATRIX APPROACH TO THE MULTICONDUCTOR TRANSMISSION LINES
Darko Kajfez Dec. 1970 77 p refs
(Grant NSF GU-3833)
(PB-197578) Avail: NTIS CSCL 09A

Following a review of the properties of TEM field distribution on multiconductor transmission lines, the scattering matrices for sections consisting of an arbitrary number of conductors are derived in a close analogy with the well-known formalism for single transmission lines. The formulas for scattering matrices of two-sided and one-sided sections are expressed directly in terms of the induction coefficient matrix. The analytical treatment of two conductors above ground includes the directional coupler and a simple design procedure for the maximally-flat phase shifter having an arbitrary phase. Author (GRA)

N71-29776*# Battelle Memorial Inst., Columbus, Ohio. Radiation Effects Information Center.
RADIATION EFFECTS DESIGN HANDBOOK. SECTION 3: ELECTRICAL INSULATING MATERIALS AND CAPACITORS
C. L. Hanks and D. J. Hamman Washington NASA Jul. 1971 87 p refs
(Contract NASw-1568)
(NASA-CR-1787) Avail: NTIS CSCL 09A

Summarized information relating to steady-state radiation effects on electrical insulating materials and capacitors is presented. The information is presented in both tabular and graphical form with text discussion. The radiation considered includes neutrons, gamma rays, and charged particles. The information is useful to design engineers responsible for choosing candidate materials or devices for use in a radiation environment. Author

N71-29822 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF OPTIMAL BALLASTS FOR GAS DISCHARGE LAMPS, USING A DIGITAL COMPUTER [RASCHET OPTIMALNYKH BALLASTOV DLYA GAZORAZRYADNYKH LAMP S PRIMENENIEM ETSVM]
A. E. Krasnopolskii et al Nov. 1970 15 p refs Transl. into ENGLISH from Svetotekhnika (USSR), v. 10, p 16–20
(NLL-RTS-6155) Avail: Natl. Lending Library, Boston Spa, Engl.; 18s; 3 NLL photocopy coupons

A method for calculating, by digital computer, the parameters of optimal chokes for starting and controlling equipment is presented. The parameters considered are: choke running voltage, choke current, supply voltage frequency, choke voltage form factor, induction, and current density. It is concluded that the programs present a means for investigating a large number of choke versions, and the accuracy of the calculations is determined by the accuracy of the assumptions for heat transfer and specific loss coefficients. F.O.S.

N71-29895# Army Electronics Command, Fort Monmouth, N.J.
DUAL MODE SYMMETRICAL HIGH FREQUENCY ANTENNA FOR AIRBORNE USE
D. V. Campbell, J. Arnold, H. Inslerman, T. Wilson Mar. 1971 42 p refs
(AD-722736; ECOM-3404) Avail: NTIS CSCL 9/5

A compact, self-contained symmetrical antenna (experimental) for airborne use at high frequencies has been developed and tested. Provisions for tuning are integrated with the radiating elements. A four-port hybrid is incorporated enabling the antenna to function in two independent modes for both transmission and reception. When symmetrically installed on a helicopter and operated in the antiphase mode, excitation of the aircraft is minimized, and a dipole pattern which is predominantly horizontally polarized obtains. When operated in the inphase mode, the resulting pattern is omnidirectional and the polarization predominantly vertical. Radiation patterns are highly predictable and the rotor effect minimal. At frequencies in the lower HF range, the noval antenna has somewhat greater gain than the much larger conventional wire antenna. Author (GRA)

N71-30097*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
JUNCTION TRANSISTOR SYNCHRONOUS RECTIFICATION
E. R. Pasciutti Jun. 1971 17 p refs
(NASA-TM-X-65595; X-761-71-216) Avail: NTIS CSCL 09C

One reliability problem of driven synchronous rectifier circuits, the double-on resulting from storage time, is illustrated for low output voltages obtained from rectification of the square-wave outputs of low input voltage converters. A comparison of the rectification efficiency and reliability of driven transistor synchronous rectifiers with that of barrier diodes indicates that the choice of rectifiers in low output voltage applications is dependent on both the source and output voltage levels of the application. Author

N71-30243# Radio Corp. of America, Lancaster, Pa.
DEVELOPMENT OF A 250 AMPERE TRANSCALENT

RECTIFIER Supplementary Report, 1 Jun.–31 Dec. 1970
S. W. Kessler Feb. 1971 24 p
(Contract DAAK02-69-C-0609)
(AD-722813; Rept-3) Avail: NTIS CSCL 9/5

During the investigation the water was frozen and its flow to the evaporator limited by the rate at which ice in the wick could be melted. External thermocouples on the heat pipes and the forward voltage of the junction were monitored to determine the transient thermal impedance of the transcalent rectifiers. The experiment was conducted by applying an average current of 250 amperes to the transcalent rectifiers in an ambient of –25C. The data was analyzed with respect to the thawing of the heat pipes. Two transcalent rectifiers were successfully cycled 55 times at their rated current before discontinuing the test. Each cycle was of sufficient length for the rectifiers to be in thermal equilibrium with their environment and consisted of 15 minutes on -15 minutes off. A summary is included of the 400 ampere RMS transcalent thyristor design which was initiated during the performance of this contract. The silicon chip design incorporates an insulated emitter gate junction structure which will be located inside the wall of the heat pipe so that the periphery of this junction can be cooled. Author (GRA)

N71-30244*# Scientific Translation Service, Santa Barbara, Calif.
THE PROBLEM OF COMPOSITES IN CAPACITOR TECHNOLOGY [DAS MISCHKORPERPROBLEM IN DER KONDENSATORENTECHNIK]
Artur Buechner Washington NASA Jul. 1971 22 p refs Transl. into ENGLISH from Wiss. Veroeffentl. aus der Siemens-Werken, v. 18, 1939 p 84–96
(Contract NASw-2035)
(NASA-TT-F-13725) Avail: NTIS CSCL 09A

The formulas for calculating the conductivity and dielectric constants of capacitors made up of composite bodies are extended to more than two components. Capacitor components can be in the form of spheres, cylinders, plates, lamella, etc. Rutile capacitors, impregnated paper capacitors, and capacitors with air gaps and dielectric losses are considered. Author

N71-30259# Ion Physics Corp., Burlington, Mass.
HIGH VOLTAGE BREAKDOWN STUDY. HANDBOOK OF VACUUM INSULATION
M. J. Mulcahy and P. C. Bolin Fort Monmouth, N.J. ECOM Mar. 1971 77 p refs
(Contract DA-28-043-AMC-00394; ARPA Order 517)
(AD-723107; ECOM-00394-20) Avail: NTIS CSCL 9/1

The Handbook on Vacuum Insulation discusses the factors influencing breakdown in high voltage vacuum devices. The data on the factors, interactions and theories on vacuum breakdown are interpreted and presented in a manner so as to be useful in the design of microwave and modulator tubes that must operate at voltages greater than 100 kV. The handbook is intended both as an introduction to, and realistic appraisal of, the use of vacuum as the insulating medium for high voltage and high power tubes. As such, it contains general discussions and recommendations pertaining to factors, levels, combinations and interactions of same, preparation, conditioning and operating procedures, etc., without, however, going into engineering and manufacturing details, discussion of which are best given in individual tube handbooks. The handbook first describes briefly the experimental program. This is followed by an introduction to the basic phenomena of vacuum insulation and a short review of the major theories of vacuum breakdown. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-29258# Joint Publications Research Service, Washington, D.C.
QUANTUM-OPTICAL INTEGRATED CIRCUITS OF GALLIUM ARSENIDE
I. S. Goldobin et al 25 Jun. 1971 3 p refs Transl. into ENGLISH from Fiz. i Tekhn. Poluprovod. (USSR), v. 5, no. 1, 1971 p 170–172
(JPRS-53462) Avail: NTIS

The effective utilization of optical transient processes in semiconductor quantum generators for the requirements of high speed computer technology requires the realization of the design principle of strong optical coupling between individual generators forming various structures. In logic, elements based on this principle, the isolated sectors of the electron hole junction are included in the resonators of various generators. Due to this, a change in the position of the Fermi quasi level in the area of interaction under the influence of the photon field of one generator controls the dynamics of radiation of the other, coupled generator. Author

N71-29351# Princeton Univ., N.J. Plasma Physics L Lab.
FUSE CHARACTERISTICS
John G. Murray and G. Bronner Oct. 1970 18 p refs
(Contract AT(30-1)-1238)
(MATT-715) Avail: NTIS

For many applications the present standard rating method for coordinating fuses is not satisfactory. Examples include the protection of solid-state devices without large safety factors, and high-voltage dc circuits. Therefore, an improved engineering and rating procedure for the application engineer is needed for such interrupting devices. A method is suggested for obtaining the arc voltage as a function of the circuit parameters and applying ratings based on this. The procedure is checked against test results for four types of fuses. Author (NSA)

N71-29536# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
18 Jun. 1971 21 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 198, no. 1, 1971 p 58–70
(JPRS-53401) Avail: NTIS

CONTENTS:

1. METHOD OF OPTIMAL REGENERATION OF SIGNALS OF SEVERAL INSTRUMENTS T. M. Zolotova p 1–6 refs (See N71-29537 17-10)

2. METHOD OF SOLUTION OF MULTICRITERIAL PROBLEMS OF CONTROL OF COMPLEX CHEMICAL-TECHNOLOGICAL SYSTEM V. V. Kafarov et al p 7–10 refs (See N71-29538 17-06)

3. METHOD OF LEAST SQUARES IN PROBLEMS OF IDENTIFICATION OF DYNAMIC SYSTEMS Y. P. Leonov p 11–17 refs (See N71-29539 17-19)

4. EXPERIMENT ON COMPUTER PROGRAMMING OF INFLUENZA EPIDEMIC L. A. Rvachev p 18–20 refs (See N71-29540 17-04)

N71-29537# Joint Publications Research Service, Washington, D.C.
METHOD OF OPTIMAL REGENERATION OF SIGNALS OF SEVERAL INSTRUMENTS
T. M. Zolotova *In its* Cybernetics and Regulation Theory 18 Jun. 1971 p 1–6 refs (See N71-29536 17-10)
Avail: NTIS

A solution is given for the problem of finding the noninertial regeneration of output signals of parallel-connected instruments ensuring maximum system precision for a given reliability of analog information systems. The solution is based on the utilization of a restoration device that performs some function of ordered sampling

The restoration function is constructed that guarantees correct system operation with simultaneous malfunctioning of all or part of the instruments and, at the same time, maximum system precision. Mathematical expressions are developed for several possible situations. N.E.N.

N71-29663 Illinois Univ., Urbana.
A STUDY OF THE SAMPLING PROCESS IN THE DC BIASED DYNAMIC CROSSED FIELD ELECTRON MULTIPLIER
Donald James Leverenz (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms Order No. 70-13390

A broadband, high gain photomultiplier, the dynamic crossed field electron multiplier has been reported by Gaddy and Holshouser. This device, due to the presence of parallel and RF electric fields and a crossed magnetic field, samples the photocurrent once each cycle of the RF electric field (the sampling period) and bunches the sampled electrons into a pulse at a dynode. These bunched electrons are then translated along the single secondary emitting dynode in order to amplify the pulse. A direct observation of the bunched collector pulses is presented for various field conditions showing that the electron bunching mechanism is operating over a wide range of field strengths. Also presented are results of an experiment from which the sampling function of this device can be inferred. This sampling function is the variation of gain during the RF sampling period and is, therefore, a measure of the sampling interval. Dissert. Abstr.

N71-29769# Technische Hochschule, Darmstadt (West Germany). Fakultaet fuer Elektrotechnik.
THE CALCULATION OF THE INPUT AMPLITUDE FUNCTIONS OF A BANDPASS FILTER FROM SAMPLED VALUES OF ITS INPUT AMPLITUDE FUNCTIONS [DIE BERECHNUNG DER AUSGANGS-AMPLITUDENFUNKTIONEN EINES BANDFILTERS AUS DEN ABTASTWERTEN SEINER EINGANGS-AMPLITUDENFUNKTIONEN]
Gunther Wiesemann (Ph.D. Thesis) 1969 89 p refs In GERMAN
Avail: NTIS

The transient response of a bandpass filter output amplitude is obtained from discrete input values by calculating the complete output function after cutting out sin and cos carrier oscillation factors. The only errors in this method develop when the bandpass transfer function is subdivided into simple partial transfer functions. Transl. by G.G.

N71-29904*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A DIGITAL REGULATED SOLAR ARRAY POWER MODULE
James E. Triner Washington Jul. 1971 19 p refs
(NASA-TM-X-2314; E-6215) Avail: NTIS CSCL 10A

A concept for regulating the power developed on a solar array at the source (i.e., on the array) was experimentally investigated. This concept permits the power developed on the array to be delivered directly to an electrical load at the voltage or current required by the load. In the particular concept investigated, regulation was achieved by controlling the power output of array segments arranged in a series and in a weighted binary fashion. The power output of an array segment could be removed from the series by shorting switches. Author

N71-30036# Joint Publications Research Service, Washington, D.C.
PSYCHOLOGICAL THEORY OF THINKING AND CYBERNETICS DEVELOPMENT
V. N. Pushkin et al 22 Jun. 1971 24 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), no. 2, 1971 p 66 79
(JPRS-53425) Avail: NTIS

The dependency between the development of cybernetic theory and practice and the results of experimental and theoretical psychology are discussed. It is psychology that defined the principles for constructing cybernetic systems which make it possible to sort variants of their passing along the branches of the problem tree, presented in the form of a labyrinth. The weaknesses and theoretical shortcomings of this path of cybernetic development and methods for overcoming the weaknesses are presented. Author

N71-30125# Technische Hochschule, Darmstadt (West Germany). Fakultaet fuer Elektrotechnik.
STUDY OF THE CYNAMICAL PROPERTIES OF CONVERTER CONTROL ELEMENTS WITH NATURAL COMMUTATION [UNTERSUCHUNG DER DYNAMISCHEN EIGENSCHAFTEN VON STROMRICHTERSTELLGLIEDERN MIT NATUERLICHER KOMMUTIERUNG]
Dierk Fritz Schroeder (Ph.D. Thesis) 1969 70 p refs In GERMAN
Avail: NTIS

A mathematical model is formulated for approximating the dynamic properties of a control element in a dynamic loop system. Volumetric signal behavior of the control element is used to deduct velocity modulation effects and their functional properties. An additional scanning system is developed to provide exact descriptions of the dynamic behavior of the control member at differing disturbances for the stationary case to prove the validity of the approximation. Transl. by G.G.

N71-30184 National Lending Library for Science and Technology, Boston Spa (England).
THE TECHNOLOGY OF THIN FILM TANTALUM NITRIDE HYBRID INTEGRATED CIRCUITS AND THEIR APPLICATIONS IN THE FIELD OF TELECOMMUNICATIONS
G. Vulliez 19 Jan. 1971 48 p Transl. into ENGLISH from Cables et Transmission (Paris), v. 24, no. 2, Apr. 1970 p 99–123
(NLL-PORS-2707-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

Different existing integrated circuits are briefly examined, and a method of manufacturing thin film tantalum nitride hybrid integrated circuits is described. The chief characteristics of these circuits, as well as an appraisal of the method of their production, are discussed. Examples of their application in the field of telecommunication are given. Author

N71-30185 National Lending Library for Science and Technology, Boston Spa (England).
MODEL OF A BIPOLAR TRANSISTOR FOR ACTIVE LINEAR AND DIGITAL NETWORKS
V. Andresciani et al 19 Jan. 1971 15 p refs Transl. into ENGLISH from Note, Recensioni e Notiz. (Italy), v. 19, no. 2, 1970 p 189–207
(NLL-PORS-2709-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A linear model of a transistor was derived for research into integrated circuits with low signal levels. The equations for the nonlinear model are expanded in series around the polarization voltages of the junctions, being limited to the first order. Admittances are obtained which are appropriately synthetized and utilized, for the common emitter configuration, in a hybrid-pi circuit having one generator. Finally, a method of measurement is described which makes it possible to determine experimentally for some transistors the alpha sub ij and tau sub ij constants, characterizing the Narud nonlinear model, and the admittances of the linear model. Author

N71-30205 National Lending Library for Science and Technology, Boston Spa (England).
RELATIONS BETWEEN THE ROLLETT STABILITY FACTOR AND THE GEOMETRIC PROPERTIES OF THE PARAMETER TRANSFORMATIONS THROUGH A TWO-PORT NETWORK

E. Carli et al 19 Jan. 1971 16 p refs Transl. from Note, Recensioni e Notiz (Italy), no. 2, Mar.–Apr. 1970 p 245–257
(NLL-PORS-2705-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Some general properties concerning the transformations between the impedances and the parameters of the general matrix representation of a two port network and the transformations of these parameters through the network are deduced. Thus an expression for the Rollett stability factor as a function of some quantities deduced from geometrical representation of the above mentioned transformations is provided. This formulation is invariant with respect to the particular network description. Starting from this characterization of the Rollett stability factor some original procedures are suggested, for its experimental determination by means of input parameters measurements only. Author

N71-30356*# Tennessee Technological Univ., Cookeville.
IDENTIFICATION OF A LINEAR SYSTEM FROM SAMPLED NOISY DATA, PART C Final Project Report
Dennis L. Luckinbill and Venilal H. Sumaria Jun. 1971 83 p refs
(Contract NAS9-10385)
(NASA-CR-115074) Avail: NTIS CSCL 09C

A modified quasilinearization parameter-identification technique, the method of perturbations, was used to find the best approximate linear system with a step input from sampled noisy data output of a nonlinear system. Automated control system simulation data for automated environmental control of an acoustic test facility at NASA Manned Spacecraft Center, Houston, Texas was utilized in the numerical experiments. A review and example of the quasilinearization method are given. The background of data being fit, least square fitted models, steady state constraint, least square analysis, and convergence of the identification scheme are outlined. A first order system and detector, superposition of a particular solution, and least square estimation are appended with figures. J.M.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-29227*# Physics International Co., San Leandro, Calif.
EXPLOSIVE HYPERVELOCITY DRAG ACCELERATOR
M. B. Gross May 1971 43 p refs
(Contract NAS9-11083)
(NASA-CR-115087; PIFR-269) Avail: NTIS CSCL 14B

The results of a program to evaluate the basic operating parameters of an explosive hypervelocity drag accelerator are presented. The drag accelerator is an explosive charge which produces a high-velocity jet of gaseous explosive products. Projectiles are launched by the drag forces of the jet. Variables studied included projectile position in relation to the charge, projectile material, type of explosive, and ambient gas within the charge bore. The growth of the boundary layer and the uniformity of the jet were also investigated. The maximum projectile velocity attained during the program was 10.0 km/sec with a steel sphere 1.6 mm in diameter. Author

N71-29234*# Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRON BEAM X-Y DEFLECTION SYSTEM Final Report
J. F. Lowry and B. W. Schumacher Jun. 1971 48 p
(Contract NAS8-26662)
(NASA-CR-119841) Avail: NTIS CSCL 14B

An electron beam X-Y deflection system designed and fabricated for retrofit on welding guns is described in detail and test results are presented. Author

N71-29241# Sandia Corp., Albuquerque, N.Mex. Heat, Plasma, Climatic, Towers Div.
GAS SPRING FIRING AND THE SOFT RECOVERY OF A HARD-WIRE INSTRUMENTED 155 mm PROJECTILE
S. L. Fluent Dec. 1970 32 p refs Sponsored by AEC
(SC-RR-70-849) Avail: NTIS

A technique used in testing hard-wire instrumented 155 mm projectiles is discussed. An 18-inch pneumatic actuator was used as the energy source while a gas spring was used to transmit the energy to the projectile and shape the longitudinal acceleration pulse. The projectile was accelerated through a short section of rifled gun barrel to produce angular acceleration simultaneously with the longitudinal acceleration. The projectile was stopped in a tapered recovery tube which was free to slide on a set of rails. This soft recovery system prevented further damage from occurring to the components inside the projectile after the initial acceleration pulse. A discussion on field testing versus gas spring testing is also presented. Author

N71-29306# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SIMULATION STUDY OF CHEVRON MARKINGS FOR AREAS ADJACENT TO RUNWAY THRESHOLDS Interim Report, Dec. 1970–Mar. 1971
Guy S. Brown and Richard L. Sulzer Jul. 1971 20 p refs
(FAA-NA-71-27; FAA-RD-71-40) Avail: NTIS

To determine the minimum system of chevron markings that would give warning to potentially deceptive, nonload-bearing paved areas before a runway threshold, 20 pilots were given systematic exposure in a flight simulator to narrowed and more widely spaced chevron patterns, and also to the present U. S. Standard. The judgments made by these pilots were that both the conventional pattern of full-width chevrons spaced 100 feet apart and a pattern of standard-width chevrons spaced 200 feet apart provided distinct and unambiguous warning of the nonload-bearing surface. Further, they reported that these two patterns were not confusable with other markings such as the runway threshold stripes. Pilot judgments of the two patterns with narrowed chevrons were mixed. While a majority reported the narrowed chevrons not confusable, there was a marked increase in the number reporting absence of distinct and unambiguous guidance, particularly when the markings were viewed from a position low on glide slope and offset from the centerline. Author

N71-29310# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
AIRCRAFT COCKPIT FOG SIMULATOR: NIGHT VERSION, VOLUME 2 Final Report
H. Rossire, A. Sussman, and C. A. Ankenbrock Jun. 1970 66 p ref
(Contract FA-67-WA-1770)
(FAA-RD-69-45-Vol-2) Avail: NTIS

The results of a program to define night fog characteristics and develop a mathematical model from which a fog program film could be produced are presented. The original concept of the unit was to be a modification of the day version. In order to meet the requirements of night fog, the simulator device has to have a different set of optics not compatible to the day version. The outline of the night fog simulator device is consequently larger than the day version. The electronics of the device are the same as for the day version except that no light source and lamp power control module are required. Author

N71-29320*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
X-RAY SOURCE FOR GRAZING INCIDENCE MIRROR TEST
C. T. Jones *In its* Instrumentation and Commun. Res. at MSFC, Vol. 4 May 1971 p 3-9 ref (See N71-29319 17-14)
Avail: NTIS CSCL 14B

The S-056 X-ray telescope is an Apollo Telescope Mount experiment that is designed to study the sun's energy from a wavelength of 200 to 2000 pm (2 to 20 A). Requirements, theory of operation, design, and use of an X-ray source for this unique application, are discussed. This design met the requirements. Author

N71-29378# Aeronautical Research Inst. of Sweden, Stockholm.
FFA STRUCTURAL RESEARCH AND TEST FACILITIES
1970 64 p
(FFA-MEMO-61) Avail: NTIS

Main activities of test facilities on structural engineering at FFA, Sweden, are described, as well as the test equipment. Other facilities serving the FFA Structures Department are reviewed. ESRO

N71-29379# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Magnetofluiddynamische Energiewandlung.
INVESTIGATIONS OF A SPECIAL CRYOPUMP FOR HIGH MASS FLOWS [UNTERSUCHUNGEN AN EINER SPEZIELLEN KRYOPUMPE FUER HOHE MASSENFLUESSE]
Ruediger Hess Feb. 1971 24 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-71-03) Avail: NTIS; DFVLR Porz: 9,30 DM

A special liquid helium cryopump was designed for use in a magnetoplasmadynamic energy conversion system. Argon plasma heated to temperatures from 6000 to 12,000 K was pumped at mass flows up to 10 g/s requiring only a reasonable consumption of liquid helium and nitrogen. Special features of this pump design included the small total system, requiring only a fraction of the necessary space of conventional rotary and diffusion pumps. Author (ESRO)

N71-29490# European Space Technology Center, Noordwijk (Netherlands).
THE MAGNETIC TEST FACILITIES AT ESTEC [INSTALLATIONS D'ESSAIS MAGNETIQUES DE L'ESTEC]
O. G. Feil Dec. 1970 43 p In FRENCH; ENGLISH summary
(ESRO-TM-134F(ESTEC)) Avail: NTIS

The magnetic test facilities at ESTEC consist essentially of a system for compensating for the earth's field and a facility for magnetization and demagnetization. These are housed in the laboratory proper, which is constructed of nonmagnetic materials. At a distance of 100 meters from the laboratory is a service building, which houses the power supplies and auxiliary equipment. A detailed account is given of the facilities for the earth's field compensation and for magnetization and demagnetization, followed by brief descriptions of the instrumentation and the handling equipment. The facilities were completed at the beginning of October 1967, since when magnetic tests on models of the ESRO satellites ESRO 1, ESRO 2, and HEOS A1 have been carried out. Author (ESRO)

N71-29499# Texas Univ., Austin. Electronics Research Center.
BIANNUAL OF ELECTRONICS RESEARCH NO. 12, PART 2 Final Report
D. G. Swanson, Edward J. Powers, Francis X. Bostick, Philip C. Richardson, and Baxter F. Womack 15 Nov. 1970 408 p refs
(Grant AF-AFOSR-1792-69)
(AD-722073; AFOSR-70-3002TR) Avail: NTIS HC $6.00/MF $0.95 ; CSCL 9/3

Research topics in progress, recent findings, and future plans in the areas of biomedical electronics; information sciences; plasma and quantum electronics; solid state electronics and acoustics and radio sciences are presented. Author (GRA)

N71-29621# National Accelerator Lab., Batavia, Ill.
PROGRESS AND PROSPECTS AT THE NATIONAL ACCELERATOR LABORATORY
Ernest Malamud and James K. Walker Dec. 1970 18 p Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, 26 Aug. 1970
(Contract AT(49-8)-3000)
(NAL-50; Conf-700806-57) Avail: NTIS

A general review is given of the progress on the NAL 500-GeV synchrotron. Both the accelerator and experimental areas are discussed. Author (NSA)

N71-29675*# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
MPI OBSERVATIONAL EQUIPMENT
B. Meyer and H. Neuss *In* NASA. Langley Res. Center Barium Releases at Altitudes Between 200 and 1000 km 1971 p 13-14 (See N71-29671 17-13)
Avail: NTIS CSCL 14B

The equipment operated by the Max Planck-Institute at Coquina Beach, N.C., and at Wallops Island is described. The optical equipment described includes: K-24 cameras, Robot cameras, spectrograph, and spectral streak cameras. F.O.S.

N71-29721# Vigo County Area Planning Dept., Terre Haute, Ind.
AN AIRPORT STUDY FOR VIGO COUNTY, INDIANA
Aug. 1970 153 p
(PB-197309; HUD-IND-70-11) Avail: NTIS CSCL 13B

The airport study is basically an inventory and evaluation of the airports in Vigo County. The historical functioning of aviation in the planning area is discussed and Hulman Field and Sky King Airport are followed from their inception to their current operations. The report proceeds to supply a data bank on airport activity during the past ten years, including commercial, general and military air movements. The study also recognized any significant trends which may have transpired in the past five years. The study then provides an examination into the relationships between airports and comprehensive planning. Land use planning and transportation planning processes are interpretated according to their relevance in achieving a harmonious and effective airport-neighboring environs relationship. Author (GRA)

N71-29756# Lane Council of Governments, Eugene, Oreg.
AIRPORT NEEDS STUDY FOR LANE COUNTY, OREGON
Jan. 1971 91 p refs
(PB-197860) Avail: NTIS CSCL 13B

The report identifies the public airports in Lane County, Oregon. The only commercial airport in the county, Mahlon Sweet Field, is examined as a regional and local airport facility. Projections of passenger and aircraft operations have been made at five year intervals through 1990. The development of the airport and the subsequent impact on land use is examined. The six general aviation airports in Lane County are also examined. Pilot, aircraft, and population distribution and land use are discussed prior to making recommendations for these airports. Author (GRA)

N71-29874# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
NEW FIRE PROTECTION SYSTEMS FOR FILTER PLENUMS
W. E. Domning *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 791-808 (See N71-29851 17-13)

Avail: NTIS HC$6.00/MF$0.95

A fire test facility was constructed consisting of a glovebox and a filter plenum which contained 12 filters. The purpose of this facility is to study the effects of a fire originating within the glovebox on the entire glovebox system which includes the filter plenum. The details of construction of the facility are shown and the results of several experiments are discussed to show the capability of the facility. Exhaust air temperatures from burning shielded gloveboxes range between 1530 to 1620 F. In order to maintain filter integrity under these conditions it is necessary to cool the air stream prior to filtration. The most successful air cooler tested was a water spray-cooled baffle inserted upstream of the initial stage of filtration. This baffle was effective in cooling 1672 F incoming air to 125 F within one minute after actuation. Author (NSA)

N71-29875# California Univ., Livermore. Lawrence Radiation Lab.

CARBON ADSORBER FIRE EXTINGUISHMENT TESTS

Jack L. Murrow *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 807-815 Sponsored by AEC (See N71-29851 17-13)

Avail: NTIS HC$6.00/MF$0.95

Activated carbon adsorbers in air cleaning systems should be protected from fire. However, as they can ignite under unusual conditions, an adequate extinguishing system should be installed ready for use. Available systems are examined. The Savannah River style cell (24 × 24 × 12 inches), containing approximately 60 pounds of 6 to 14 mesh carbon, was used for these tests. Single bead spray nozzles and arrays delivering up to 36 gallons per minute (gpm) at operating pressures to 150 psig, with patterns from fog to solid cone were tried using plain water and water with wetting agent. Under the conditions of this test, water sprays did not extinguish the fire as long as air continued to flow. Liquid nitrogen was used successfully as an extinguishing agent under the same conditions. The rate of application to a single adsorber was 20 liters per minute for seven minutes. Author (NSA)

N71-29880*# National Aeronautics and Space Administration, Washington, D.C.

A RECENT SIGNIFICANT CLEAN ROOM FIRE

D. J. Keigher *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 839-840 (See N71-29871 17-13)

(NASA-TM-X-67250) Avail: NTIS CSCL 14B

A fire in a one-story brick and plywood building used as a clean room for cleaning and packaging delicate hardware for NASA applications is described. NSA

N71-29906# Naval Ordnance Lab., White Oak, Md.

NOL HYPERVELOCITY WIND TUNNEL REPORT NO. 3: THEORETICAL ANALYSIS OF THE BOUNDARY LAYER IN THE NOZZLE

Neal Tetervin 26 Feb. 1971 45 p refs

(AD-722346; NOLTR-71-7) Avail: NTIS CSCL 14/2

The equations used to calculate the boundary layer properties for use in the design of the Mach 10, 15, and 20 axisymmetric nozzles of the hypervelocity wind tunnel at NOL are derived. One equation is the integral moment-of-momentum differential equation for the boundary layer velocity profile shape parameter; the form of the equation is valid for a real gas. This equation is used with an axisymmetric integral momentum equation that is valid for thick as well as for thin boundary layers to calculate the total thickness and the displacement effect of the boundary layer. Author (GRA)

N71-29907# Naval Ordance Lab., White Oak, Md.

NOL HYPERVELOCITY WIND TUNNEL REPORT NO. 1: AERODYNAMIC DESIGN

E. Leroy Harris and Walter J. Glowacki 26 Feb. 1971 64 p refs

(AD-722345; NOLTR-71-5) Avail: NTIS CSCL 14/2

The NOL hypervelocity wind tunnel will provide a high Reynolds number turbulent flow simulation in the Mach number range 10 to 20. This facility, much needed for large-scale testing of hypersonic vehicles, is under construction and will be operational late in 1972. Supply pressures up to 40,000 psi will be maintained constant for 1 to 4 seconds during which stable, condensation-free flow conditions will prevail. Very high Reynolds numbers are obtained by operating with nitrogen at temperatures just sufficient to avoid test section condensation. The facility, which operates in a blowdown mode, has separate legs for the three design Mach numbers 10, 15, and 20. Each leg is fitted with its own storage heater, diaphragm assembly, contoured nozzle, and diffuser. The three legs share a common gas storage supply, test cell and model support system, and vacuum sphere. The report highlights the more significant considerations leading to the aerodynamic design of the facility and includes discussions of the need for the facility, the initial requirements imposed on its design, and brief descriptions of the layout and operation of the facility. Author (GRA)

N71-30034# National Bureau of Standards, Washington, D.C. Activation Analysis Section.

ACTIVATION ANALYSIS SECTION: SUMMARY OF ACTIVITIES, JULY 1969-JUNE 1970

Philip D. La Fleur and Donald A. Becker, eds. Dec. 1970 169 p refs

(NBS-TN-548) Avail: SOD $1.25

An extensive discussion of the value of 3-MeV neutrons in neutron generator activation analysis and the experimental parameters for using these neutrons are presented. The target and pneumatic transfer systems for photon activation analysis are described and the application of photon activation analysis for determining thallium in glass and high purity metals and gold, manganese and iron in high purity cadmium is discussed. Research into determination of nitrogen by photon activation analysis is described. A computer program, ALSPIS, for peak finding and integration is described and the application of a mini-computer to the activation analysis section is noted. Author

N71-30051# California Univ., Berkeley. Lawrence Radiation Lab.

ELECTRON-RING ACCELERATOR PROGRAM AT BERKELEY

J. M. Peterson, W. W. Chupp, A. A. Garren, D. Keefe, G. R. Lambertson et al 20 Oct. 1970 21 p refs Presented at 2nd Natl. Conf. on Particle Accelerators, Moscow, 11 Nov. 1970

(Contract W-7405-eng-48)

(UCRL-20150; Conf-701120-2) Avail: NTIS

The Compressor 2 and Compressor 3 experiments are discussed, and the development of a new 4-MeV 500-A electron linear induction accelerator is described. An outlook into the future possibilities of electron-ring accelerators is given. NSA

N71-30055*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

LEWIS 9- BY 15-FOOT V/STOL WIND TUNNEL

Joseph A. Yuska, James H. Diedrich, and Nestro Clough Washington Jul. 1971 48 p refs

(NASA-TM-X-2305; E-6055) Avail: NTIS CSCL 14B

The V/STOL wind tunnel was built in the return leg of the 8 by 6 foot supersonic wind tunnel. The test section has a velocity range of 13.4 to 78.2 meters per second. The features of the wind tunnel are described, and the results of the initial calibration are presented in sufficient detail to guide prospective users in designing experiments. The methods used to design the tunnel inlet section, the test section wall slot geometry, and the diffuser section are also described. Author

N71-30237# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

TRAINER, FLIGHT SIMULATOR Final Report
4 Mar. 1971 32 p refs
(AD-723031; MTP-7-3-110) Avail: NTIS CSCL 14/2

The document provides a basis for preparing test plans to evaluate the performance of flight simulation trainers. It considers the performance of the student pilot, instructor and the system computer. Author (GRA)

N71-30258# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
GROUND SUPPORT SERVICE EQUIPMENT (AVIATION) Final Report
12 Mar. 1971 54 p refs
(AD-723036; MTP-7-2-055) Avail: NTIS CSCL 1/5

The procedure describes test methodology and testing techniques necessary to determine the technical performance and safety characteristics of ground support service aviation equipment and associated accessories. Author (GRA)

N71-30263*# Scientific Translation Service, Santa Barbara, Calif.
SURVEY OF THE EXPERIMENTAL CAPABILITIES OF THE ONERA HYDRODYNAMIC TUNNEL WHICH OFFERS FLOW VISUALIZATION [APERCU SUR LES POSSIBILITIES EXPERIMENTALES DU TUNNEL HYDRODYNAMIQUE A VISUALISATION DE L'ONERA]
H. Werle Washington NASA Jul. 1971 57 p refs Transl. into ENGLISH of French report ONERA-NT-48
(Contract NASw-2035)
(NASA-TT-F-13727; ONERA-NT-48) Avail: NTIS CSCL 14B

After a review of the conditions in which the O.N.E.R.A. hydrodynamic water-wind tunnel is used, a discussion of it's experimental capabilities is presented with several examples of recent research. Author

N71-30355*# Tennessee Technological Univ., Cookeville.
AUTOMATED ENVIRONMENTAL CONTROL OF AN ACOUSTIC TEST FACILITY, PART A Final Project Report
Dennis L. Luckinbill and Charles Everett Jan. 1971 82 p refs
(Contract NAS9-10385)
(NASA-CR-115072) Avail: NTIS CSCL 14B

Mathematical models are developed of the present open loop system and a closed loop system of the Spaceflight Acoustics Laboratory, using a digital computer for control. The problem considered is a random signal driving the system and creating an acoustical noise spectrum inside the test chamber. A computer control algorithm is investigated for optimal or near optimal control of the noise spectrum inside the test chamber and a digital simulation of the closed loop system is programmed to evaluate the overall system, using the proposed computer control algorithm. Controllers in general are investigated, and also random inputs to a system from the statistical point of view. E.M.C.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-29316# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TIME-DEPENDENT CALCULATION METHOD FOR TRANSONIC NOZZLE FLOWS [METHODE INSTATIONNAIRE DE CALCUL DE L'ECOULEMENT TRANSSONIQUE DANS UNE TUYERE]
Pierre Laval 1970 23 p refs In FRENCH; ENGLISH summary
(ONERA-NT-173) Avail: NTIS

A time-dependent method is developed to compute mixed two dimensional or axisymmetric flow in a nozzle with or without central body. The time-dependent equations of motion are used in conservative form, with transformed spatial independent variables. An explicit second-order accurate difference scheme, similar to a two-step Richtmyer scheme, is set up with an artificial viscosity term. Results are presented for an annular nozzle and for five classical axisymmetric nozzles with small throat radius of curvature (the ratio of curvature radius to nozzle radius at the throat varying from 0.8 to 0.1). Excellent agreement is found with experimental data and in particular with experimental results obtained for a conical converging nozzle. Author (ESRO)

N71-29372# California Univ., Los Angeles. Dept. of Mathematics.
APPLICATIONS OF HARMONIC PRINCIPAL FUNCTIONS TO FLUID DYNAMICS AND THERMODYNAMICS
Dan Martinez Feb. 1971 42 p refs
(Grant DA-ARO(D)-31-124-71-G20)
(AD-721902; AROD-9653-9-M; TR-50) Avail: NTIS CSCL 20/4

In this work the author systematically applies the theory of principal functions to fluid dynamics and thermodynamics. Author (GRA)

N71-29393# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
LOW-SPEED THREE-DIMENSIONAL TURBULENT BOUNDARY-LAYER DATA, PARTS 1 AND 2
L. F. East and R. P. Hoxey London Aeron. Res. Council 1971 84 p refs Supersedes RAE-TR-69041; ARC-31362; RAE-TR-69137; ARC-31721
(ARC-R/M-3653; RAE-TR-69041; ARC-31362; RAE-TR-69137; ARC-31721) Copyright. Avail: NTIS; HMSO: £2.20; BIS: $7.92

A comprehensive low-speed experiment on a three-dimensional turbulent boundary layer is presented and the results are given in detail. The two parts of the experiment are concerned with different regions of the flow in the vicinity of the up-stream portion of an obstruction placed in a thick two dimensional boundary layer. The free-stream velocity is 200 ft/s and a typical Reynolds number based upon the boundary layer momentum thickness and local free-stream velocity is 50,000. Author (ESRO)

N71-29394# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Heterogene Stroemungen.
MASS TRANSFER FROM A SINGLE SPHERE IN STOKES FLOW [STOFFUEBERGANG AN EINER EINZELKUGEL IN STOKESSCHER STROEMUNG]
Lutz Reichle Oct. 1970 29 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-73) Avail: NTIS; ZLDI Munich: 8.80 DM

Mass transfer from a single sphere to a surrounding fluid flow is investigated theoretically in Stokes flow. By neglecting free convection terms the differential equation of mass transfer is solved approximately with the aid of an explicite finite-difference method and the concentration profiles are computed. From the concentration profiles Sherwood numbers defined for mass transfer are calculated. For the special cases of high and low values of the Peclet number the numerical results are completed by well known, analytical solutions of the differential equation. Author (ESRO)

N71-29491# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
LAMINAR BOUNDARY LAYER WITH INJECTION
Michel Dudeck and Gerard Lassau Jan. 1971 34 p refs In FRENCH
(Rept-71-1) Avail: NTIS

Gas injection in a flow through a porous wall involves difficult problems as soon as a precise control is required because

of interactions between the two faces of the plate having influence on boundary layer velocity profiles, flow pattern, and efficiency of the injection. The influence of the nonporous leading edge on the dynamic profile of the boundary layer and on the conditions for a uniform injection is analyzed. This analytical solution leads not only to an approximated joining between the two zones with and without injection but also to a rather simple mathematical formulation which can easily be solved numerically. ESRO

N71-29508# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE MECHANISMS OF THE EFFECT OF DISSOLVED MACROMOLECULES ON TURBULENT FRICTION

G. F. Kobets 22 Dec. 1970 21 p refs Transl. into ENGLISH from Bionika (USSR), no. 3, 1969 p 72–80

(AD-722286; FTD-MT-24-271-70) Avail: NTIS CSCL 20/4

The decrease in the turbulent friction in non-Newtonial liqs. was determined as a function of the physical properties of the dissolved molecules and of the hydrodynamic conditions (particularly Reynolds No.). Data obtained from solutions of synthetic polymers (e.g., CM-cellulose and poly(vinyl alc.)) or bio-polymers (e.g., polysaccharides and fish slime) suggested that a decrease in the turbulent friction was dependent on the rheological constants of the solution and its concentration. The effects of the dissolved macromolecules on the turbulent friction in non-Newtonian liquids was interpreted in terms of an anisotropic viscosity hypothesis. Author (GRA)

N71-29544# Washington Univ., Seattle.

A FLUID-MECHANICAL REFRACTING GAS-PRISM Progress Report, 15 Jan. 1970–14 Jan. 1971

W. H. Christiansen Jan. 1971 103 p refs

(Grant AF-AFOSR-1723-69)

(AD-721711; AFOSR-TR-71-0612) Avail: NTIS CSCL 20/6

It is shown that, in principle, for certain monotonically decreasing inhomogeneous, toroidally-shaped media, wave functions and real numbers exist. The waves are confined to a certain central region depending on the type of media, the density profile and the mode order. Thus, it would appear that resonators of this type can support bound waves and thus they can be used to store electro-magnetic energy (photon capacitor) or in the case of active media the structure may support laser modes. The type of inhomogeneous toroidal resonator described is still in its initial stages of conception and development. Questions such as the optimal media and how the efficiency of the toroidal inhomogeneous resonator compared with that of other kinds of resonators still remain to be answered. Author (GRA)

N71-29574 National Lending Library for Science and Technology, Boston Spa (England).

THE CODE EDITH: CALCULATION OF THE DYNAMIC AND THERMAL CHARACTERISTICS OF A GAS CIRCUIT IN VARIABLE FLOW CONDITIONS. APPLICATION TO THE STUDY OF THE BEHAVIOUR OF A REACTOR UNDER NATURAL CONVECTION FLOW CONDITIONS

J. Rousseau et al 19 Jan. 1971 35 p Transl. into ENGLISH from French Report CEA-R-3915, 1969

(NLL-CE-Trans-5373-(9022.09); CEA-R-3915) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

A numerical method is outlined for treating the thermodynamic behaviour of a compressible fluid in a closed circuit under variable flow conditions. The calculation is performed step by step, by applying the equations for conservation of momentum and continuity, for conservation of energy, and for convective heat transfer to the gas flowing in a closed circuit. Author

N71-29619# General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.

FILM BOILING HEAT TRANSFER AND DRAG REDUCTION Final Report

Archibald Gay Apr. 1971 86 p refs

(Contract N00014-70-C-0095)

(AD-722428; GDCA-DDB-71-001) Avail: NTIS CSCL 14/2

Preparations were made for turbulent film boiling tests of a heated flat plate model in the California Institute of Technology high speed water tunnel. The model and most of the support instrumentation has been assembled. The high heat flux anticipated to maintain film boiling with forced convection is produced by cartridge heaters embedded in the copper body of the model. The heater power controlers are designed to provide independent control of the heater banks in six chordwise zones. Approximate analyses of the two-phase forced-convection boundary layer flow was carried out for both laminar and turbulent flows. The analyses indicate considerable skin friction drag reduction in both flow regimes. This reduction is typically around 90 percent for water flow around a surface heater to 1000 - 2000 degrees F. Author (GRA)

N71-29622 National Lending Library for Science and Technology, Boston Spa (England).

NOISE DUE TO FLUID FLOW

19 Jan. 1971 4 p Transl. into ENGLISH from Ver. Deut. Ing. Z. (West Germany), v. 112, 1 Apr. 1970 p 423

(NLL-CE-Trans-5424-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A survey of the various forms and causes of flow induced noise is presented. The causes of noise associated with discharge effects, propellers, blowers, jet engines, boundary layers, water pipes, and supersonic aircraft are described and, where possible, empirical formulas for the expected acoustic power are given. A theoretical treatment of flow induced noise is included. Author

N71-29623 Illinois Univ., Urbana.

ON THE KINETIC EQUATIONS FOR A DILUTE, SHORT RANGE GAS

Tom Jennings Forster (Ph.D. Thesis) 1969 137 p

Avail: Univ. Microfilms Order No. 70-13312

This investigation of a kinetic description for a short range gas includes a brief survey of the background and use of correlation functions in kinetic theory. A derivation from classical mechanics of new kinetic equations for slightly dense and dilute short range gases is presented. Consideration is given to the formal solution of the dilute, short range gas equations, the relation between this description and the Boltzmann equation, and the role of the collision event as the mechanism for system evolution. The solution for the first iterate for the problem of an infinite plane wall moving with constant velocity into a gas is also considered. Dissert. Abstr.

N71-29664 Pennsylvania State Univ., University Park.

FINITE ELEMENT ANALYSIS METHODS IN DYNAMICS OF PULSATILE FLOW

Gautam Ray (Ph.D. Thesis) 1969 116 p

Avail: Univ. Microfilms Order No. 70-13875

The study of viscous flow in the developed region under arbitrary time varying pressure gradient was extended to yield directly the velocity and shearing stress profile at the vessel walls for incompressible laminar flow condition in the inlet section of a straight cylindrical tube as well as a channel for both steady and pulsating flow. The special effect of symmetric and asymmetric plugging in such inlet sections for the development of shearing stress and the changes in velocity profile that it produces has been studied from the point of view that such an analysis may be useful for studying endothelial tissue damage. Wave propagation through both viscous and inviscid fluid filled tube due to pulsating and pressure has also been studied together with some special effect due to bifurcation of the flow. While most of the analysis was carried out for Newtonian fluid, recognizing the non-Newtonian nature of blood, effect of non-Newtonian characters on certain hemodynamic properties have been studied. Dissert. Abstr.

N71-29686 Princeton Univ., N.J.
SECOND ORDER WAVE STRUCTURE IN SUPERSONIC FLOWS
David A. Caughey (Ph.D. Thesis) 1969 105 p
Avail: Univ. Microfilms Order No. 70-14194

Second-order effects upon the wave systems associated with bodies in uniform supersonic flight are considered. An appropriate scaling of the independent variables is introduced to take into account the locally small, but cumulative, nonlinearities which undermine the validity of the classical perturbation theories at large distances from the body. For planar flows, the simple wave results of Friedrichs as corrected and extended by Lighthill are confirmed, with a minor correction noted for the location of the rear shock at very great distances from the body. For flows about finite bodies, the wave structure solution must be matched with a quasi-cylindrical, local solution to provide the inner boundary condition. Predicted shock angles for the flow over slender wedges (planar flow) and cones (axisymmetric flow) are compared with exact inviscid calculations to show the improvement afforded by inclusion of second-order effects. Dissert. Abstr.

N71-29716# Technische Hochschule, Darmstadt (West Germany). Fakultaet fuer Maschinenbau.
THE PRESSURE DROP OF TWO-PHASE FLOWS IN VERTICAL CYLINDRICAL PIPES [DER DRUCKABFALL VON ZWEIPHASENSTROEMUNGEN IN SENKRECHTEN KREISROHREN]
Jochen Orthuber (Ph.D. Thesis) 1970 110 p refs In GERMAN
Avail: NTIS

A two phase mixed gas-liquid flow is considered that is mostly present in steam boilers, boiling water reactors, and chemical technological processes. Various density functions are used to optimize the fundamental flow resistance law for the two phase flow so that pressure-friction values can be calculated from a reduced number of parameters. Transl. by G.G.

N71-29728 Illinois Univ., Urbana.
HYDROELASTIC VIBRATION OF RODS IN PARALLEL FLOW
Richard Mazumi Kanazawa (Ph.D. Thesis) 1969 157 p
Avail: Univ. Microfilms Order No. 70-13372

The vibration of rods excited by water flowing parallel to the rod axis was investigated. A mathematical model for the hydroelastic rod and a method for evaluating an equivalent viscous damping coefficient are presented. It is assumed that the rod is excited by a random pressure field and, as a consequence, that the rod vibration is random. The rod displacement in fully developed turbulence and downstream from orifice is considered and the experimental data are processed by using digital methods of random data analysis. An empirical expression for the root mean square rod displacement as a function of dimensionless water velocity and orifice size is presented. The measured mean square spectral densities of the rod displacement are used to estimate the spectrum of the net transverse pressure acting on the rod. The estimated actual pressure spectrum is shown to be roughly two orders of magnitude below both the measured net transverse pressure spectrum and the spectrum of boundary layer pressure fluctuations in air flows. Dissert. Abstr.

N71-29729 Illinois Univ., Urbana.
AERODYNAMIC DRAG OF TWO-DIMENSIONAL RECTANGULAR NOTCHES IN TRANSONIC AND SUPERSONIC TURBULENT FLOW (WITH EMPHASIS ON THE EFFECTS OF SELF-INDUCED PRESSURE OSCILLATIONS)
Otis Wayne McGregor, Jr. (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms Order No. 70-13412

The drag of relatively short rectangular cavities (length-to-depth ratios of 0.50 to 3.0) with turbulent shear layers has been measured at transonic and supersonic Mach numbers (0.3 to 3.0). Of particular importance is the effect of pressure oscillations within the cavity (commonly referred to as cavity resonance) which is shown to increase the drag as much as 250 percent. Cavity resonance is found to occur over the entire Mach number range investigated and other work has shown it to occur at both lower and higher Mach numbers. The frequency of the pressure oscillations is satisfactorily predicted by the vortex wave interaction model. The effects of external reinforcement of resonance by reflection of radiated pressure waves are examined. Existing methods for predicting cavity drag are inadequate to cope with this phenomenon. A new model for predicting the lower bound of cavity drag (non-resonating cavity) is presented. Analytical considerations are utilized to indicate the qualitative effect of resonance on cavity drag. Dissert. Abstr.

N71-29746# Tennessee Univ., Knoxville. Dept. of Engineering Mechanics.
TURBULENT MIXING IN SUBMERGED TWO DIMENSIONAL WALL JETS
C. S. Chu and C. J. Remenyik Dec. 1970 28 p refs
(Grant DI-14-01-0001-1994)
(PB-198029; EM-71-2) Avail: NTIS CSCL 20D

A plane, horizontal, two-dimensional, incompressible, turbulent wall-jet of air was studied experimentally. Results indicate that the distributions of the mean velocity directions do not become similar with increasing distance from the nozzle. The self-similar form of the nondimensional mean velocity profile develops within a distance of about 9 nozzle heights from the nozzle exit. It appears that the various turbulence intensities and the Reynolds shear stress reach similarity states at different distances between 16.3 and 20.1 nozzle heights from the nozzle exit. The concept of eddy viscosity does not promise to be very useful in dealing with wall jets. Author (GRA)

N71-29764# Naval Civil Engineering Lab., Port Hueneme, Calif.
A FLUIDIC SYSTEM FOR MIXING TWO FLUIDS: DEVELOPMENT STUDY
D. Pal Feb. 1971 28 p refs
(AD-722316; NCEL-TN-1150) Avail: NTIS CSCL 13/7

Results of a study on the use of proportional fluid amplifiers for the mixing of two fluids are presented. The system proposed is considered capable of mixing fluids in varying mixture ratios. For this application, the fluidic device promises to be superior to conventional mechanical flow modulating devices. The fluidic mixing system being tested uses a double leg elbow amplifier and is designed for mixing hot and cold water. Author (GRA)

N71-29755# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
NUMERICAL STUDIES OF ASYMMETRIC AND THERMODYNAMIC EFFECTS ON CAVITATION BUBBLE COLLAPSE
Terry Michael Mitchell Dec. 1970 184 p refs
(Grant NSF GK-730)
(PB-198040; UMICH-03371-5-T) Avail: NTIS CSCL 20D

The effects of asymmetric and the thermodynamic parameters on theoretical models of cavitation bubble collapse were examined in an effort to better understand the modes of collapse and the causes of cavitation damage. Four different sources of asymmetry in bubble collapse in a viscous, incompressible liquid were examined using numerical methods; they include the effect of a slight perturbation from spherical symmetry, the effects on initially spherical bubbles of a linear pressure gradient, of a liquid velocity relative to the bubble, and of proximity to a rigid wall. The slightly

perturbed bubble calculation showed that outward perturbations on the initial profile of a bubble will essentially involute as the collapse progresses and tended to confirm the instability of a spherical bubble surface during collapse in terms of growth of perturbations.
Author (GRA)

N71-29782 Illinois Univ., Urbana.
THE MASS-SPECTROMETRIC SAMPLING OF SHOCK-TUBE FLOWS FOR THE STUDY OF HIGH-TEMPERATURE REACTION RATES
George Sanzong (Ph.D. Thesis) 1969 213 p
Avail: Univ. Microfilms Order No. 70-13469

A critical survey of all the major sources of error in the sampling of shock tube gas with a mass spectrometer for the study of chemical reaction rates at high temperatures in the gas phase, is described. With the exception of the possible error due to boundary layer cooling, all sources of error are shown to be either negligible or subject to elimination by proper instrument design. The experiments reported clearly demonstrate the importance of not only the geometry of the ion source but also the location and geometry of the free jet. Limitations of transient flow are probed. Data taken from the literature and from experiments reported here are shown to be predictable. The consequences of these phenomena for chemical kinetic studies with the shock tube are discussed. A complete description of the shock tube quadrupole mass-filter apparatus used in the experiments reported is given; the theory of operation of the quadropole mass filter is discussed in detail.
Dissert. Abstr.

N71-29815*# Techtran Corp., Glen Burnie, Md.
PENETRATION DEPTH OF A ONE-ROW ROUND JET SYSTEM DEVELOPING IN A LIMITED CROSS WIND [GLUBINA PRONIKNOVENIYA ODNORYADNOY SISTEMY KRUGLYKH STRUY, RAZVIVAYUSHCHIKHSYA V OGRANICHENNOM POPERECHNOM POTOKE]
V. Zlobin et al Washington NASA Jul. 1971 7 p refs Transl. into ENGLISH from Izvestiya Akad. Nauk Est. SSR, Fiz.-Mat., (USSR), v. 18, no. 3, 1969, p 331–335
(Contract NASw-2037)
(NASA-TT-F-13726) Avail: NTIS CSCL 20D

The problem of calculating the penetration depth of a one-row round jet system developing in a limited cross wind under conditions most typical for gas burners is considered. Analytical formulae are deduced and contribute to a greater precision in the approximate empirical relationships used at the present time. Comparison with well-known experimental data agrees well with the calculation proposed.
Author

N71-29827 Washington Univ., Seattle.
A SECONDARY FLOW MODEL FOR THE PLANETARY BOUNDARY LAYER
Robert Alan Brown (Ph.D. Thesis) 1969 77 p
Avail: Univ. Microfilms Order No. 70-14737

The equations of motion for a neutrally bouyant fluid are solved to produce an equilibrium flow consisting of a modified Ekman spiral mean flow plus a helical secondary flow. By considering the secondary flow to be a finite perturbation on a mean large scale flow, approximate equations are obtained for the secondary flow and the modified mean flow as functions of the synoptic conditions. When the energetics of this system is considered, an equilibrium magnitude for the secondary flow can be obtained. The finite perturbations are assumed to preserve the structure of the infinitesimal perturbation solutions for the dynamic instability of the Ekman boundary layer. In particular, helical rolls occur as finite perturbation solutions. These finite disturbances are found to alter the mean Ekman velocity profile such that it becomes stable.
Dissert. Abstr.

N71-29891 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF VELOCITY DISTRIBUTION AND WALL SHEAR STRESS FOR AXIAL TURBULENT FLOW IN INFINITE ARRAYS OF PARALLEL RODS
W. Eifler et al 15 Dec. 1970 21 p refs Transl. into ENGLISH from Warme und Stoffubertragung (West Germany, v. 2, no. 4, 1969 p 248–256 In ENGLISH and GERMAN
(NLL-W-441-(9081.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A theoretical model is described for calculating the turbulent flow parallel to rod assemblies arranged in a tri- or rectangular-array; it is assumed that momentum transport takes place exclusively by turbulent diffusion. In order to calculate the necessary velocity profiles and distribution of apparent kinetic viscosity normal to the rod circumference, the values were taken for the inner concentric zone. An anisotropic viscosity was assumed to compare the theoretically predicted values with those measured experimentally at a triangular pitch. A value of 10 was found for the ratio of viscosity for the momentum transport in peripheral and radial directions. Using this value of the anisotropy factor, the flow behavior was investigated for triangular and rectangular rod arrays as a function of rod spacing.
Author

N71-29893 California Univ., Los Angeles.
AN EXPERIMENTAL MODEL FOR VISUAL STUDIES OF TURBULENT FLOW IN POROUS MATERIALS
Chester Richard Kyle (Ph.D. Thesis) 1969 178 p
Avail: Univ. Microfilms Order No. 70-14298

A two dimensional experimental model has been developed to simulate turbulent flow in porous materials. It uses cross flow through a matrix of cylinders between parallel plexiglass plates. Matrix geometry was chosen to approximate a bed of packed spheres. Pressure loss and axial dispersion in several models have been measured over a wide range of flow rates in the non-Darcy region. Photographs have been taken of flow patterns developed in the transition from laminar to fully turbulent flow. The conditions under which non-linear flow and turbulence begins are discussed. All typical characteristics of flow through beds of packed spheres were exhibited; however, both pressure loss and dispersion differed somewhat when compared to similar three-dimensional flow. Notwithstanding, the matrix of cylinders is a good analog of turbulent flow in porous materials.
Dissert. Abstr.

N71-29896*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid, Thermal and Aerospace Sciences.
EXPERIMENTS ON A TURBULENT JET IN A CROSS FLOW
Yasuhiro Kamotani and Isaac Greber Jun. 1971 174 p refs
(Grant NGR-36-027-008)
(NASA-CR-72893; FTAS/TR-71-62) Avail: NTIS CSCL 20D

Results are reported of experiments on turbulent circular jets issuing into a cross flow, both for unheated and heated jets. Longitudinal and transverse distributions of velocity, pressure, temperature, and turbulence intensity are presented. The velocity distributions depend on the ratio of jet to cross flow momentum flux. The temperature distributions depend also on the density ratio. The jet structure is dominated by a vortex wake which forms behind the jet, which is evident both from the detail measurements and from smoke photographs of the flow. The experiments also indicate that the components of cross flow normal and parallel to the jet trajectory independently control the entrainment rate.
Author

N71-29908*# TRW Systems Group, Redondo Beach, Calif.
USER'S MANUAL FOR THE TRW GASPIPE PROGRAM. A VAPOR-GAS FRONT ANALYSIS PROGRAM FOR HEAT PIPES CONTAINING NONCONDENSIBLE GAS
D. K. Edwards, G. L. Fleischman, and S. D. Marcus Apr. 1971 88 p refs
(Contract NAS2-5503)
(NASA-CR-114306; TRW-13111-6072-R0-00) Avail: NTIS CSCL 20D

A digital computer program is described which is useful in the design and analysis of heat pipes which contain noncondensible gases: either for temperature control or to aid in start-up from the frozen state. The program includes the effects of axial conduction and mass diffusion on the performance of such heat pipes and permits the calculation of the wall temperature profile along a gas loaded heat pipe; the amount of gas loading necessary to obtain a desired evaporator temperature at a desired heat load; the heat load versus the evaporator temperature for a fixed amount of gas in the pipe; the heat and mass transfer along the pipe, including the vapor-gas front region; the heat leak when the condenser is filled with gas; freezing occurance and rate in the condenser; and the information required to size the gas reservoir of gas controlled heat pipes. The program contains numerous reservoir options which allow it to be used for hot or cold reservoir passive control as well as heated reservoir active control heat pipes. Additional input options permit its use for parametric studies and off-design performance predictions as well as heat pipe design. Author

N71-29918 Illinois Univ., Urbana.
LONGITUDINAL WAVE PROPAGATION IN LIQUID LINES OF FINITE LENGTH INCLUDING THE EFFECT OF NONLINEAR BOUNDARY CONDITIONS
Richard Dean Strunk (Ph.D. Thesis) 1969 75 p
Avail: Univ. Microfilms Order No. 70-13507

The dynamic response of liquid lines of finite length for both periodic and nonperiodic inputs is presented. For the periodic input, the harmonic distortion generated when the line is terminated by a nonlinear orifice characteristic is predicted by using a perturbation method of solution. For the nonperiodic input, the transient solution to an arbitrary input is obtained by representing the system transfer function by an infinite product. The perturbation method is shown to be representative of the true phenomenon and to give very good quantitative as well as qualitative information. The harmonic distortion generated is predicted within two percent of the numerical solution by this method. The infinite product method is shown to be a feasible method for obtaining exact transient solutions. The solution is in the form of an infinite series which has an infinite product in each term. The product and series may be truncated to any desired accuracy. Dissert. Abstr.

N71-29920*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JET PENETRATION INTO MACH 2 AIRSTREAM USING SWEPT BACK INJECTORS AT ANGLE OF ATTACK
Martin Hersch and Louis A. Povinelli Washington Jul. 1971 28 p refs
(NASA-TM-X-2319; E-6159) Avail: NTIS CSCL 20D

Helium was injected at sonic velocity normal to the leeward side of arrow-and delta-wing injectors. Vortex-controlling parameters including sweepback angle, swept-edge length, swept-edge wedge angle, and angle of attack were constant, but blockage and calculated drag were lower for the arrow injectors. The changes in vortex-enhanced penetration and lateral spreading were less rapid than the changes in blockage area and calculated drag. Also, helium, when injected from a porous area on the windward side, was swept over into the leeward vortex. Penetration in the vortex region was then greater than when helium was injected at sonic velocity directly into the vortex from the leeward side. Author

N71-30059# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
CONDITIONAL SAMPLING OF TURBULENT SHEAR FLOWS
R. A. Antonia and P. Bradshaw Jan. 1971 35 p refs Sponsored in part by CSIRO
(Grant B/SR/7377)
(IC-Aero-71-04) Avail: NTIS

Hot wire signals recorded in the outer part of a turbulent boundary layer and in the intermittent high velocity zone of a mixing layer have been conditionally sampled to obtain an ensemble average of the velocity and fluctuation intensity patterns both within the turbulent bursts and throughout the irrotational region. The patterns are generally almost symmetrically distributed with respect to the mid-point of the region considered except that the ensemble average velocity in the irrotational region is higher just before a turbulent burst than just after it. Author

N71-30136*# Scientific Translation Service, Santa Barbara, Calif.
AN EXPERIMENTAL DETERMINATION OF THE MAGNITUDE OF ACCELERATED MOLECULAR DIFFUSION IN TURBULENT MIXING OF SUPERSONIC WAVE FLOWS [EKSPERIMENTALNOYE OPREDELENIYE VELICHINY USKORENNOY MOLEKULYARNOY DIFFUZII PRI TURBULENTNOM SMESHENII SPUTNYKH SVERKHZVUKOVYKH POTOKOV]
A. I. Maltsev Washington NASA Jul. 1971 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, Nov.–Dec. 1970 p 59–65
(Contract NASw-2035)
(NASA-TT-F-13574) Avail: NTIS CSCL 20D

An experimental study was made of the magnitude of accelerated molecular diffusion in turbulent mixing of supersonic wake flows in a cylindrical chamber. A relation was obtained between the magnitudes of accelerated molecular diffusion and total turbulent mixing which gives the fraction that was mixed before achieving molecular homogeneity. The method of invesitgation involved optical observations of diffusion and did not introduce any perturbations in the flow. Author

N71-30137*# Scientific Translation Service, Santa Barbara, Calif.
NONSTATIONARY RAREFACTION FLOWS HAVING SYMMETRY [O NESTATSIONARNYKH TECHENIYAKH RAZREZHENIYA, OBLADAYUSHCHIKH SIMMETRIEY]
O. V. Rysev Washington NASA Jul. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), No. 6, 1970 p 35–39
(Contract NASw-2035)
(NASA-TT-F-13571) Avail: NTIS CSCL 20D

Nonstationary isentropic rarefaction flows having axial or central symmetry are examined. Using the canonical form for describing the relationships satisfied along the characteristics, it is shown that under specific conditions the rarefaction flows may contain a characteristic along which the velocity and speed of sound change during flow from a certain steady source. Author

N71-30148# Technische Hogeschool, Eindhoven (Netherlands).
ON THE HYDRODYNAMIC BEHAVIOR OF PARALLEL BOILING WATER CHANNELS
Antonius Christianus Maria Van Vonderen (Ph.D. Thesis) 1971 147 p refs
Avail: NTIS

The results of an experimental and theoretical investigation into the hydrodynamic behavior of parallel boiling channels are reported. The experimental rig could be operated in natural or in forced circulation, employing water as a test fluid. The test section comprised three, uniformly heated, inside-cooled, boiling channels, which were connected to a common inlet and outlet plenum. Experiments were performed at 15.5 and 30 bar. The influence of pressure, inlet subcooling and different combinations of channel orifices, on the steady-state and dynamic hydraulic characteristics and the influence of a pump on the stability of parallel channels were emphasized. The inlet subcooling was varied from 1 to 35 C; the values of the inlet loss factors were 1.4 and 8.0 velocity heads. An attempt was made to predict the experimental results with a nonlinear computer program that described the hydrodynamics of three parallel boiling channels. Author

N71-30188# Martin Marietta Corp., Denver, Colo.
RESULTS OF A SHOCK TUBE EXPERIMENT IN COMPRESSIBLE TURBULENT MIXING
Richard J. Sanderson and Peter C. Steel Mar. 1971 40 p refs
(Contract N00014-67-A-0226-0005; Proj. SQUID)
(AD-722693; MAR-1-PU) Avail: NTIS CSCL 20/4

Two-dimensional supersonic turbulent mixing layers were produced with a small shock tunnel whose driven section is divided into two parallel chambers. When desired, combustion in the mixing layer was produced by use of oxygen in one stream and an argon-hydrogen mixture in the other. Variation in refractive index through the mixing layer was measured with a Mach-Zehnder interferometer and pressures were measured with piezo-electric transducers. From these measurements, freestream conditions could be computed. Approximate temperatures could be deduced directly from the interferograms throughout the mixing layer. A finite difference computer program which solves the turbulent conservation equations in terms of an empirical eddy viscosity model and a simple ignition delay-reaction time model for the chemistry was used to reconstruct the refractive index contours. Such an approach can describe the conditions in the mixing layer to an adequate degree of accuracy. It was found that for nonreacting mixing layers, the growth rates were comparable to those obtained from the literature for incompressible layers, and that the liberation of chemical energy increased mixing rates considerably, at least for the conditions of this experiment. Author (GRA)

N71-30180*# Scientific Translation Service, Santa Barbara, Calif.
THE EQUATION OF THE ENERGY BALANCE FOR TURBULENT PULSATIONS IN THE THEORY OF A FREE TURBULENT BOUNDARY LAYER [URAVNENIYE BALANSA ENERGII TURBULENTNYKH PULSATSIY V TEORII SVOBODNOGO TURBULENTNOGO POGRANICHNOGO SLOY]
N. I. Akatnov et al Washington NASA Jul. 1971 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, Nov.–Dec. 1970 p 75–79
(Contract NASw-2035)
(NASA-TT-F-13575) Avail: NTIS CSCL 20D

Semi-empirical formulas are proposed for the turbulent viscosity coefficient and the turbulence scale which enter into the system of equations for a free turbulent boundary layer in an incompressible liquid. The system in question consists of the equations of continuity, motion, and the balance of the mean energy of turbulent pulsations. The advantage that the proposed formulas have over the existing ones consists in the fact that the two empirical constants appearing in the system of equations have very close values for spherical and plane turbulent jets, as well as for a turbulent boundary layer at the edge of a semi-infinite homogeneous flow with a stationary liquid. Author

N71-30264# Imperial Coll. of Science and Technology, London (England).
THE FLOW IN S SHAPED DUCTS
P. Bansod and P. Bradshaw Apr. 1971 27 p refs
(IC-71-10) Avail: NTIS

Measurements are presented of total pressure, static pressure, surface shear stress, and yaw angle in the flow through several S-shaped ducts, each with a thin turbulent boundary layer at entry. The results show that the region of low total pressure in the exit plane, found by previous workers, is due to a vortex-stretching mechanism which may also appear in other flows. Author

N71-30278*# Remtech, Inc., Birmingham, Ala.
A STUDY OF TURBULENCE MEASUREMENTS USING LASER DOPPLER SYSTEM Interim Report, Jun. 1970–Jun. 1971
C. E. Fuller 27 May 1971 75 p refs
(Contract NAS8-25896)
(NASA-CR-119804; RTR-002-1) Avail: NTIS CSCL 20D

The object of the wing tip vortex test is to demonstrate the extent with which the Laser Doppler Velocimeter system can be used for the measurement of gas velocities with high spatial and temporal resolution. This test was planned to provide three dimensional mean velocity data of the vortex pattern shed from a wing tip at an angle of attack. These measurements are being conducted at the MSFC 7 × 7 inch wind tunnel facility. The test plan and procedure as well as the measurements that were made are included. In addition, data on several measurements of the system's operating parameters which are important to these tests are also given. E.M.C.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-29217# Montana State Univ., Bozeman.
AN AIRBORNE RADIOMETRIC SNOW SURVEY SYSTEM
Paul W. Jordan Sep. 1970 87 p
(Contract AT(45-1)-2061)
(RLO-2061-1) Avail: NTIS

A prototype system for the airborne measurement of the water equivalent stored in a snowpack on an inaccessible mountain watershed is described. The ground emplacement consists solely of a radioisotope; the reduction in upward gamma flux is related to snow–water content lying above that source. The airborne system and technique necessary to measure and accomplish this are outlined. The mathematical relationships involved are evaluated; and the method of determining each of the parameters of altitude, airspeed, gamma count, etc. is discussed. Experimental validation is cited. As an adjunct to developing a prototype system for measuring, from the air, snow–water equivalent, it was necessary to design tables and graphs to relate maximum expected snow–water depth to isotope type and magnitude and to shield thickness and weight. Data are developed and presented in graph form, which will allow a quick decision as to the optimum combination of elements for any new snow course site which may be under consideration. Author (NSA)

N71-29235*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TERRESTRIAL ENVIRONMENT (CLIMATIC) CRITERIA GUIDELINES FOR USE IN SPACE VEHICLE DEVELOPMENT
Glenn E. Daniels, ed. 10 May 1971 383 p refs Revised
(NASA-TM-X-64589) Avail: NTIS HC $8.00/MF $0.95 CSCL 03B

Guidelines are provided on probable climatic extremes and probabilities-of-occurrence of terrestrial environment data specifically applicable for NASA space vehicles and associated equipment development. The geographic areas encompassed are the Eastern Test Range (Cape Kennedy, Florida); Huntsville, Alabama; New Orleans, Louisiana; The Space and Missile Test Center (Vandenberg AFB California); Sacramento, California; Wallops Test Range (Wallops Island, Virginia); White Sands Missile Range, New Mexico; and intermediate transportation areas. In addition, sections are included to provide information on the general distribution of natural environment extremes in the United States (excluding Alaska and Hawaii), cloud cover, and some worldwide climatic extremes. Although all these areas are covered, the major emphasis is given to the Kennedy Space Center launch area due to importance in NASA's large space vehicle programs. Author

N71-29236# Commissariat a l'Energie Atomique, Saclay (France.) Center d'Etudes Nucleaires.

A STUDY USING RADIOACTIVE TRACERS OF THE EXCHANGE BETWEEN VARIOUS ZONES OF THE ATMOSPHERE OVER THE CONTINENTS AND OCEANS [ETUDE PAR LES TRACEURS RADIOACTIFS DES ECHANGES ENTRE LES DIVERSES ZONES DE L'ATMOSPHERE AU-DESSUS DES CONTINENTS ET DES OCEANS]

Ba Cuong Nguyen (Ph.D. Thesis — Paris Univ.) Jan. 1971 175 p refs In FRENCH

(CEA-R-3977) Avail: AEC Depository Libraries

Measurements of Cs-137 radioactivity and total beta activity from nuclear explosion fallout and of aerosols in suspension in the air, were made over high mountains, the ocean, and the continental plain. From these results, together with measurements of natural radioactivity at altitudes up to 5000 m, a model for the circulation of aerosols in the lower troposphere, over land, and sea was established. Zones of high fallout, probably due to jet stream undulations, were established. The existence of these zones accounts the ratio of intensities of oceanic fallout to continental fallout varying between 1 and 4. Author (NSA)

N71-29239# Bureau of Mines, Pittsburgh, Pa.

NITROGEN Preprint from the 1969 Bureau of Mines Minerals Yearbook

Walter C. Lorenz Washington [1970] 10 p refs

Avail: SOD $0.10

Tables, for comparative purposes, are given of the production, and uses, both foreign and domestic, of nitrogen and nitrogen compounds. Data are also given on prices and foreign trade. Technological developments in the economic production of nitrogen based fertilizers and other products are included. E.H.W.

N71-29243*# Techtran Corp., Glen Burnie, Md.

IONIZATION INSTABILITY IN IONOSPHERIC PLASMA [IONIZATSIONNAYA NEUSTOYCHIVOST V IONOSFERNOY PLAZME]

A. V. Bogdanov Washington NASA Apr. 1971 17 p refs Transl. into ENGLISH of Acad. of Sci. USSR, Inst. for Space Res., Moscow, report Pr-39

(Contract NASw-2037)

(NASA-TT-F-13616; Pr-39) Avail: NTIS CSCL 01A

The instability resulting in Joule heating of electrons in weakly ionized plasma in the presence of a current flowing in it is examined. A possible system of currents occurring during aureolal activity is analyzed with the assumption that the system of currents closes through the magnetosphere along force lines extending from the ends of the electron stream, and then through the region of circular current. Only the ionospheric portion of the current is examined. The electron stream is assumed to be practically homogeneous. The spreading of the heterogeneity of electron concentration due to diffusion along and across the magentic field is examined. The influence of ions on the diffusion process is considered. The basic processes that occur in weakly ionized plasma in the presence of a current are analyzed. Author

N71-29304# Environmental Science Services Administration, Boulder, Colo. Research Labs.

N2, O2, AND O DENSITIES IN THE 80-120 km REGION COMPATIBLE WITH THE US STANDARD ATMOSPHERE

Gene W. Adams Sep. 1970 22 p refs

(ESSA-TR-ERL-184-SDL-17) Avail: SOD $0.30

The N2, O2, and O number density profiles were constructed as a function of altitude, latitude, and season which are compatible with the U. S. Standard Atmosphere, 1962, and the U. S. Standard Atmosphere Supplements, 1966. Profiles have been constructed at 15, 30, 45, and 60 deg N. for winter, summer, and spring/fall. Author

N71-29311# Environmental Science Services Administration, Boulder, Colo. Research Labs.

IONOSPHERIC ELECTRON CONCENTRATION MEASUREMENTS AT THE MAGNETIC EQUATOR, 1964 - 1966

J. P. Mc Clure, D. T. Farley, Jr., and Robert Cohen Sep. 1970 41 p refs

(ESSA-TR-ERL-186-AL-4) Avail: SOD $0.50

Contour plots of ionospheric electron concentration data obtained during 1964 to 1966 at the Jicamarca Radar Observatory, Lima, Peru, are presented. A summary of data reduction methods and a discussion of errors are included. Author

N71-29373# Research Inst. of National Defence, Stockholm (Sweden).

AN INCLUSION FORMULA FOR DERIVATIVES

Torsten Stroem [1970] 5 p refs

Avail: NTIS

Often an estimate of a derivative or its range over an interval is desired rather than the derivative itself. Error terms for numerical approximations may sometimes be rigorously estimated in terms of a number of values of the derivative and a "majorant. This is indicated and a nechnique is proposed for the strict estimation of the values of the derivatives in terms of central differences of the function and its "majorant. Author (ESRO)

N71-29376# Atomic Weapons Research Establishment, Aldermaston (England).

SURFACE WAVES GENERATED BY ATMOSPHERIC NUCLEAR EXPLOSIONS

E. W. Carpenter and P. D. Marshall Nov. 1970 42 p refs

(AWRE-O-88/70) Avail: AEC Depository Libraries

An approximate theoretical analysis is given for Rayleigh waves generated by atmospheric nuclear explosions. An analysis is made of the seismic recordings of Russian explosions at Novaya Zemlya and quantitative agreement with the theory is found. Values for the absorption coefficient of the earth are derived and proposals are made for a wider use of the stationary phase approximation. Author (NSA)

N71-29390# Research Inst. of National Defence, Stockholm (Sweden).

A NOTE ON ROMBERG QUADRATURE

Torsten Stroem [1970] 6 p

Avail: NTIS

Some properties are derived of individual elements in the Romberg scheme and the extrapolation idea introduced by Havie is extended. Author (ESRO)

N71-29396# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

POLARIZATION OF GEOMAGNETIC PULSATIONS

L. L. Vanyan, L. A. Abramov, M. B. Gokhberg, N. A. Deniskin, L. V. Kiziria et al 1970 14 p refs

(PR-46) Avail: NTIS

A model for determining the elliptical polarization of geomagnetic pulsations is proposed. The magnetic field of pulsations on the earth's surface is generated by two ionospheric sources located in the high latitudes of the northern and southern hemispheres and rotating in reverse directions. The influences of night and day variations are taken into account. ESRO

N71-29397# Royal Aircraft Establishment, Farnborough (England).

SPATIAL SURVEILLANCE OF NATURAL RESOURCES. PART 2

D. I. Raitt, comp. Jul. 1969 16 p refs For part 1 see RAE-LIB-BIB-308; N70-21145 09-13)

(RAE-LIB-BIB-314-Pt-2; RAE-LIB-BIB-308) Avail: NTIS

This selective bibliography, arranged alphabetically by author, covers the following fields: mineral deposits, agriculture (vegetation, crops, soils), forestry, wildlife, livestock, fisheries, and water resources. Author (ESRO)

N71-29398# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

THEORETICAL MODELS OF THE NEUTRAL COMPOSITION OF THE THERMOSPHERE

M. N. Izakov 1969 38 p refs Presented at the 12th Meeting of the Intern. Assoc. of Geomagnetism and Aeronomy, Madrid, 1969

(D-0004) Avail: NTIS

Existing thermospheric models are described and compared with experimental data. An attempt is made to determine further ways of improving models and the knowledge of thermospheric composition. ESRO

N71-29402# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 255 28 Jun. 1971 p 23–40 (See N71-29399 17-34)

Avail: NTIS

News briefs and abstracts of scientific articles concerning oceanography are presented. Topics discussed include method for measuring spatial spectrum of sea waves, temperature fluctuations in ocean, currents in Arctic Basin, and magnetic anomalies in rift zone of the Atlantic Ocean. F.O.S.

N71-29403# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 255 28 Jun. 1971 p 41–48 (See N71-29399 17-34)

Avail: NTIS

News briefs and abstracts of scientific articles concerning terrestrial geophysics are presented. Topics discussed include gravimeter on movable base, magnetospheric resonator, analysis of Tashkent earthquake frequencies, tectonics of Sea of Japan, and magnetic properties of Atlantic bottom sediments. F.O.S.

N71-29404# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 255 28 Jun. 1971 p 49–55 (See N71-29399 17-34)

Avail: NTIS

News announcements are presented of the launchings of Kosmos-422, 423, 424, 425, 426, Soyuz-11, and Mars-2. In addition, abstracts of articles concerning ionization in the middle-latitude E sub s layer, and observations of nighttime, twilight and daytime horizons from a spacecraft are presented. F.O.S.

N71-29434# Institute of Geological Sciences, Hailsham (England). Geomagnetism Unit.

USER MANUAL AND CATALOGUE FOR MACHINE-READABLE DATA

D. R. Barraclough and Marion P. Fisher [1970] 18 p

(Rept-7) Copyright. Avail: NTIS

The organization of the Geomagnetism Data Center is described and the input format for punched cards, paper tape, and magnetic tape given. ESRO

N71-29449# Sandia Corp., Albuquerque, N.Mex. Spectroscopy Div.

SURVEY OF CONTAMINATION (ITS NATURE, DETECTION, AND CONTROL)

Mar. 1971 64 p refs Sponsored by AEC

(SC-M-70-303) Avail: NTIS

A broad survey of the field of contamination is presented including its nature, detection, and control. Updated and new information was added to material which was previously reported. Case histories of a number of production items are included to illustrate typical problems that arise during assembly operations, and the solutions to these problems are given. The need for a comprehensive training program is discussed, and the objectives and scope of such a program are outlined. Author

N71-29450# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

MICROFLUCTUATIONS IN COLLISIONLESS SHOCK WAVE FRONT

E. M. Dubinin, G. G. Managadze, and I. M. Podgorny 1969 17 p refs In RUSSIAN and ENGLISH

(PR-5) Avail: NTIS

A laboratory experiment was set up to simulate the magnetospheric shock front in a collisionless plasma. The fluctuations of the magnetic field were investigated by means of two magnetic probes and oscillograms are presented. ESRO

N71-29534# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

ON THE NORMAL MODES OF THE EARTH'S MAGNETIC TAIL OSCILLATIONS

A. I. Ershkovich 1969 14 p refs Presented at the 12th Meeting of the Intern. Assoc. of Geomagnetism and Aeronomy, Madrid, 1969 Submitted for publication

(D-0003) Avail: NTIS

Attention is paid to the fact that the period of the geomagnetic tail's fundamental mode of oscillation and the characteristic time of the magnetospheric substorms have the same order of magnitude. It is shown that the energy of these oscillation is enough for the magnetospheric substorm initiation. Probably the magnetospheric substorm's origin is connected with the release of this energy in the inner magnetosphere. The observed tail's flapping may be the manifestation of the tail's normal modes. ESRO

N71-29627 National Lending Library for Science and Technology, Boston Spa (England).

SOME SPECIAL FEATURES OF THE ATMOSPHERIC CIRCULATION AND THE THERMAL STATE OF THE OCEAN IN PRE-WINTER AND WINTER

G. M. Prosekina et al 24 Jun. 1970 8 p ref Transl. into ENGLISH from Leningrad. Gidromet. Nauc-Issled. Cent. (SSSR), v. 43, 1969 p 78–82

(NLL-M-9269-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A study was made of the conditions in the lower stratosphere and troposphere and at the ocean surface layer preceding mild and severe natural synoptic winters over western USSR. It was found that mild winters followed the presence of a single cyclone in the stratosphere over the Arctic during November and a negative value of the temperature anomalies at the ocean surface. Severe winters followed the presence of one cyclone in the stratosphere over the Arctic, two cyclones in the troposphere over lower latitudes, and positive values of the height of the 500 mb surface. N.E.N.

N71-29649# Air Force Cambridge Research Labs., Bedford, Mass.

SOME SOLUTIONS OF THE DIFFUSION EQUATION FOR AN EXPANDING GAS CLOUD IN A CONSTANT SHEAR FLOW

Antonio F. Quesada 12 Feb. 1971 22 p

(AD-722437; AFCRL-71-0111) Avail: NTIS CSCL 4/1

Analytical solutions of the differential equation that describes

a diffusion process in the presence of a constant background velocity gradient have been obtained and are reported in this paper. They are useful for the proper interpretation of experimental data collected during the course of chemical releases in the upper atmosphere, to allow more accurate determination of diffusion coefficients. Chemical releases are a powerful tool for the study of atmospheric properties, and are carried out in support of USAF functional requirements in satellite operation, in missile detection, and in communications. Author (GRA)

N71-29650# Air Force Cambridge Research Labs., Bedford, Mass.
HIGH LATITUDE SPORADIC E
Eugene W. Pittenger and George J. Gassman 5 Feb. 1971 66 p refs
(AD-722435; AFCRL-71-0082; AFCRL-ERP-347) Avail: NTIS CSCL 4/1

Previous research results on high latitude sporadic E are surveyed, and replotted and displayed in Corrected Geomagnetic Latitude (CGL) AND Corrected Geomagnetic Time (CGT) and related to current research results. Patterns of occurrence of sporadic E are developed, showing percent of time of occurrence in location in the CGL/CGT coordinate system, in terms of sporadic E top frequency (fE sub s) and magnetic activity level. Patterns of E sub s occurrence are related to concepts of the auroral oval, polar cap, and substorms. Sporadic E with top frequency = or > MHz is related to substorms. This sporadic E occurs in the late evening-early night sector of the CGL/CGT coordinate system. Implications of sporadic E on high latitude HF propagation during solar cycle maximum and minimum are discussed. Author (GRA)

N71-29671*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BARIUM RELEASES AT ALTITUDES BETWEEN 200 AND 1000 KILOMETERS: A JOINT MAX-PLANCK-INSTITUT-NASA EXPERIMENT
Hal T. Baber, Jr., Kenneth H. Crumbly, and David Adamson, comps. Washington 1971 145 p refs
(NASA-SP-264) Avail: NTIS CSCL 04A

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8. NASA OPTICAL INSTRUMENTATION K. H. Crumbly p 69–73 (See N71-29679 17-14)

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N71-29672*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
[HISTORICAL DEVELOPMENTS OF BARIUM RELEASE EXPERIMENTS] Introduction
Hal T. Baber, Jr. *In its* Barium Releases at Altitudes between 200 and 1000 km 1971 p 1–2 refs (See N71-29671 17-13)
Avail: NTIS CSCL 04A

The use of ionized clouds for making direct measurements of the electric field in the magnetosphere is presented. A mixture of 75 percent Ba, 25 percent CuO by weight was found to yield ionized barium vapor for the application of ion cloud techniques. Objectives of the project were to study ion cloud techniques at altitudes between 200 and 1000 km, and to measure electric fields in the lower magnetopause by optical observations of the motion of ionized clouds. F.O.S.

N71-29673*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VEHICLES AND TRAJECTORIES
Hal T. Baber, Jr. *In its* Barium Releases at Altitudes between 200 and 1000 km 1971 p 3–8 refs (See N71-29671 17-13)
Avail: NTIS CSCL 04A

The Javelin, and Nike-Tomahawk sounding rockets used in the barium release experiments of September 24 and 25, 1966 are described. Charts for the trajectories from Wallops Island with release points are included. F.O.S.

N71-29674*# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
PAYLOAD DESCRIPTION
H. Foeppl and J. Stoecker *In* NASA. Langley Res. Center Barium Release at Altitudes between 200 and 1000 km 1971 p 9–12 (See N71-29671 17-13)
Avail: NTIS CSCL 04A

The payload configurations of the Javelin and Nike-Tomahawk sounding rockets are described. The chemical composition of the payload mixtures is given. F.O.S.

N71-29676*# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
MPI ANALYSIS OF OBSERVATIONS
G. Haerendel, R. Luest, and B. Meyer *In* NASA. Langley Res. Center Barium Releases at Altitudes between 200 and 1000 km 1971 p 15–46 refs (See N71-29671 17-13)
Avail: NTIS CSCL 04A

The second release from the Javelin vehicle at an altitude of about 930 km is discussed since this experiment exhibited the widest spectrum of fascinating physical and visual phenomena. The neutral barium vapor in the high-altitude release expanded like a thin, nearly spherical shell. The total brightness of the cloud of neutral barium atoms decreased rapidly because of the photoionization which leads to the creation of the ion cloud. This ion cloud was easily distinguishable from the neutral cloud by its different color and shape. Once formed, it became discernible shortly after release as a narrow cloud elongated along the direction of the magnetic-field line intersecting the point of release. The cloud attained a maximum length of about 1000 km. Particles initially moving upward and subjected to the pull of gravity began to descend after a while, and the cloud began to shrink. Particles piled up in the altitude range from about 300 to 350 km as a result of their being slowed down by collisions with the neutral atmosphere. This is the so-called sedimentation phase during which the cloud's lower extremity grew in brightness and apparent width and its length decreased to about 80 km. While the sedimentation was proceeding, striations parallel to magnetic-field lines were observed to appear within the cloud; at the same time it drifted slowly at right angles to the magnetic field as a result of the influence of the electric field, the measurement of which was one of the essential goals of the ion cloud experiments. Author

N71-29677*# Johns Hopkins Univ., Baltimore, Md. Inst. for Cooperative Research.
SPECTROPHOTOMETER MEASUREMENTS
K. A. Dick *In* NASA. Langley Res. Center Barium Releases at Altitudes Between 200 and 1000 km 1971 p 47-60 refs (See N71-29671 17-13)
(Grant NGR-21-001-001)
Avail: NTIS CSCL 04A

The barium releases on September 24, 1966, were observed from a site at The Johns Hopkins University (39.4 N, 76.6 W). The emission spectra of the releases were recorded in the wavelength region from 3490 A to 6490 A by using a 0.5-meter Ebert spectrophotometer. Nineteen spectral features were recorded and have been identified as four lines of singly ionized barium Ba II; 14 lines of neutral barium Ba I; and the resonance line of neutral strontium Sr I, an impurity in the release. Author

N71-29678*# North Carolina State Univ., Raleigh. Dept. of Physics.
PHOTOMETRY OF BARIUM ION CLOUDS
E. R. Manring *In* NASA. Langley Res. Center Barium Releases at Altitudes between 200 and 1000 km 1971 p 61-68 refs (See N71-29671 17-13)
(Grant NGR-34-002-042)
Avail: NTIS CSCL 04A

Photometry of the barium ion emission at 4554 A for the five clouds generated on September 24 and 25, 1966, is reported from observations made from Coquina Beach, North Carolina. This work was undertaken to determine ionization efficiency of the payloads used and photon scattering rate from ionized barium. For design purposes it is desirable to know each of these parameters independently since photometric measurements involve the product of these two quantities. Estimates of the scattering rate are used to evaluate ionization efficiency. Preliminary estimates of ionization efficiency were made and are reported. The scattering rate per ion is taken as equal to the absorption rate per ion since collisional deactivation at the ambient pressure is believed to be negligible. This rate is also a product of two quantities. One of these involves the oscillator strength of the transition and the other, the incident solar flux at 4554 A. Calibration details are included to permit a reevaluation of the data should more information on these basic parameters become available. Author

N71-29680*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
TRIANGULATION
C. G. Justus, A. Woodrum, and W. B. Moseley *In* NASA. Langley Res. Center Barium Releases at Altitudes Between 200 and 1000 km 1971 p 75-96 refs (See N71-29671 17-13)
(Grant NGR-11-002-004)
Avail: NTIS CSCL 04A

The results of the triangulation studies of the barium releases of September 24 and 25, 1966, are discussed. Data presented include position of the neutral clouds, position and motion of the Javelin ionized cloud, and radial growth of the neutral clouds. The position data include slant ranges from the camera sites. Author

N71-29681*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA ANALYSIS OF SECOND BARIUM RELEASE FROM JAVELIN
David Adamson *Inits* Barium Releases at Altitudes between 200 and 1000 km 1971 p 97-140 refs (See N71-29671 17-13)
Avail: NTIS CSCL 04A

Data obtained from the release made from the Javelin at about 930 km are analyzed and discussed. Estimates are made of the electric-field distribution to about 1100 km and an upper bound established on the level of fluctuations in the field. In addition, a comparison has been made of cloud elongation and drift along the magnetic-field line with theoretical estimates. Author

N71-29727 Pennsylvania State Univ., University Park.
SOME ASPECTS OF NEUTRON ACTIVATION ANALYSIS OF SILICATE ROCKS
Tjalle Thys Vandergraaf (Ph.D. Thesis) 1969 163 p
Avail: Univ. Microfilms Order No. 70-13897

Due to the complexity of gamma spectra obtained from irradiated silicates and other geological and extraterrestial materials by scintillation detectors, chemical separations are necessary in most cases. The number of separation steps can be reduced, however, if group separations are made. In order to bring the silicates into solution, the irradiated silicate samples are fused with lithium metaborate in graphite crucibles. A computer program is developed which will eliminate from consideration the interference caused by some elements of relatively low abundance in geological materials or elements which have unfavorable nuclear properties. In order to solve the problem of adding flux monitors to gauge the neutron flux to which the standards and samples are exposed, intrinsic flux monitors are used. Using a rapid chemical separation step to remove the transition metals from the bulk of the sample, and using optimum irradiation and decay times, copper is determined in five silicate samples, and, with an additional chemical separation step, lanthanum is also determined. Dissert. Abstr.

N71-29742# University of Southern Calif., Los Angeles.
A CRITICAL SURVEY OF SIX THERMODYNAMIC AND TRANSPORT PROPERTIES OF AIR, 1957-1969
George Karl Gardiner Feb. 1971 111 p refs
(Contract N60530-67-C-0499)
(AD-722402; NWC-TP-4997) Avail: NTIS CSCL 4/1

A survey of six thermodynamic and transport properties of air was conducted for a range of pressures and temperatures corresponding to the conditions experienced by a vehicle flying at altitudes ranging from sea level to 300,000 feet, and velocities ranging from 0 to 15,000 ft/sec. The properties considered include enthalpy, compressibility, and specific heat at constant pressure, and viscosity, thermal conductivity and Prandtl number. Theoretical methods and experimental results are compared, and graphs and tables are presented that summarize the results from the various references. It was found that all methods for calculating thermal properties were in good agreement; however, discrepancies were found to exist between various methods of calculating transport properties. Recommendations are given as to which theory should be used to calculate each of the properties under consideration. Author (GRA)

N71-29743# Naval Weapons Lab., Dahlgren, Va.
IMPROVEMENTS IN RAPID DETERMINATION OF GEODETIC POSITION
E. Joyce Greeley Mar. 1971 17 p refs
(AD-722399; NWL-TR-2553) Avail: NTIS CSCL 8/5

A study was conducted to determine the accuracy achievable in determining the three components of the geodetic position of a site in the minimum time possible, the time required to receive and analyze data from two Doppler satellite passes. If only the satellites now in orbit are considered, this time interval ranges from one to five hours. While it is currently the practice to require a one-week span of satellite observations to determine a precise geodetic position, the study showed that 10 meter accuracy could be obtained in just a few hours. Author (GRA)

N71-29763# Texas A&M Univ., College Station. Coastal and Ocean Engineering Div.
SET-UP OF OIL ON WATER BY WIND
Edmund B. Spencer and Robert M. Sorensen Aug. 1970 142 p refs
(Grant NSF GH-88)
(PB-198113; TAMU-SG-70-220; COE-128) Avail: NTIS CSCL 08C

Set-up of various density and viscosity oils on water's surface when subjected to wind was studied analytically and experimentally using a two dimensional wind-wave channel. The primary objective of the study was to verify the controlling equations and establish dimensionless parameters by experimental analysis. Analysis of the results shows that set-up of oil is a function of wind stress and wind generated wave action. The empirical parameters developed allow prediction of oil set-up when subjected to various steady state wind conditions. Author (GRA)

N71-29788# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Naturwissenschaftlichen Fakultaet.

TIME AND LOCAL DEVELOPMENT OF GEOMAGNETIC DISTURBANCES OF THE TYPE DP-1 [ZEITLICHE UND OERTLICHE ENTWICKLUNG GEOMAGNETISCHER STOERUNGEN VOM TYP DP-1]

Eberhard Seiler (Ph.D. Thesis) 1970 146 p refs In GERMAN
Avail: NTIS

Geomagnetic bay disturbances caused by magnetospheric storms are analyzed to obtain their time and local development histories. Disturbances start on the daylight side of earth and differ from each other in the polar light zone. Disturbance vortices inside the polar light oval flow in a westerly direction with pronounced concentrations in the night-side polar electrojet. An easterly jet is observed in the afternoon and evening sector between 65 deg and 75 deg geomagnetic width. Disturbance variations below 60 deg in the night-side are very homogeneous and are probably determined by reversed flows of the easterly as well as of the westerly jets. Transl. by G.G.

N71-29810# Philco-Ford Corp., Palo Alto, Calif. Space and Re-entry Systems Div.

OCEANOGRAPHIC IMAGE ENHANCEMENT Final Report, Mar. 1969 - Jan. 1970

Donald S. Ross 15 Jan. 1970 48 p ref
(Contract N62306-69-V-0072)
(AD-722482; SRS-TR-DA2164) Avail: NTIS CSCL 14/5

Eleven images of ocean subjects selected from Gemini and Apollo 70 mm color photography were enhanced by Photo-optical means, producing false-color contours of small changes in density and color. Bathymetry, sediment concentrations and flow patterns are delineated by the process, interpretation and information yield improved. Correlation with charted depth contours was found, in one instance to 20 fathoms, although none of the photography was optimum for water penetration. The utility of space photography and enhancement processes for determining relative water depths and updating charts is apparent from this and previous work. The results of spectral filter tests for water penetration conducted under the same contract and reported in detail earlier are summarized. Author (GRA)

N71-29829# PhotoMetrics, Inc., Lexington, Mass.

ANALYSES OF ATMOSPHERIC CHEMICAL RELEASES Final Report, 2 Feb. 1970 - 31 Jan. 1971

Irving L. Kofsky, John C. Bowman, James J. Costa, Ronald H. Johnson, and Christian A. Trowbridge 26 Feb. 1971 42 p refs
(Contract F19628-70-C-0188)
(AD-722484; PHM-104-71; AFCRL-71-0127) Avail: NTIS CSCL 4/1

A program of analysis and interpretation of photometrically-calibrated photographic and vidicon images of chemical releases in the upper atmosphere is described. Contributions to the program also included photometer measurements of the resonance scattering of sunlight by clouds of atoms, calibration of the relative aperture of camaera lenses at near-ultraviolet wavelengths and construction of a standard uniform-radiance light source for use in the field. Author (GRA)

N71-29830# Arizona Univ., Tucson. Off. of Arid Lands Studies.

AN ANNOTATED BIBLIOGRAPHY AND EVALUATION OF REMOTE SENSING PUBLICATIONS RELATING TO MILITARY GEOGRAPHY OF ARID LANDS

William G. McGinnies Natick, Mass. US Army Earth Sci. Lab. Sep. 1970 112 p refs
(Contract DAAG17-67-C-0199)
(AD-723061; USA-NLABS-TR-71-27-ES-61) Avail: NTIS CSCL 8/6

A comprehensive review has been made of remote sensing publications relating to military geography of arid lands. These have been abstracted or annotated and arranged in tables relating devices and processes to geographic features including terrain, groundwater, surface materials, cultural features, flora, fauna, weather and climate, coastal zones, and general geography. The devices and processes include black and white, color, and infrared photography and devices utilizing longer wave lengths such as radar. Vehicles include conventional airplanes and spacecraft. Each reference is rated as especially useful, useful, or of little value. Author (GRA)

N71-29831# American Inst. of Crop Ecology, Silver Spring, Md.

AICE SURVEY OF USSR AIR POLLUTION LITERATURE. VOLUME 1: ATMOSPHERIC AND METEOROLOGICAL ASPECTS OF AIR POLLUTION

M. Y. Nuttonson Dec. 1969 122 p refs
(Grant AP-00786-01)
(PB-198061; APTD-0635) Avail: NTIS CSCL 13B

A survey of U.S.S.R. air pollution literature was conducted by the American Institute of Crop Ecology. Atmospherical and meteorological aspects of air pollution are discussed including an airstream as a factor in the transport of products of atmospheric pollution, propagation of noxious pollutants from high sources as a function of synoptic-meteorological factors, and the theory of atmospheric diffusion under fog conditions. Results of experimental studies of atmospheric pollution in the region of an electric power plant are reported. Finally, calculation of dispersal of precipitating contaminant from a linear source in the boundary layer of the atmosphere is treated. E.M.C.

N71-29832# American Inst. of Crop Ecology, Silver Spring, Md.

AICE SURVEY OF USSR AIR POLLUTION LITERATURE. VOLUME 3: THE SUSCEPTIBILITY OR RESISTANCE TO GAS AND SMOKE OF VARIOUS ARBOREAL SPECIES GROWN UNDER DIVERSE ENVIRONMENTAL CONDITIONS IN A NUMBER OF INDUSTRIAL REGIONS OF THE SOVIET UNION

M. Y. Nuttonson Dec. 1969 125 p refs
(Grant AP-00786-01)
(PB-198063; APTD-0637) Avail: NTIS CSCL 13B

A survey of U.S.S.R. air pollution literature was conducted by the American Institute of Crop Ecology. The susceptibility or resistance to gas and smoke of various arboreal species grown under diverse environmental conditions in a number of industrial regions is investigated. E.M.C.

N71-29833# American Inst. of Crop Ecology, Silver Spring, Md.

AICE SURVEY OF USSR AIR POLLUTION LITERATURE. VOLUME 2: EFFECTS AND SYMPTOMS OF AIR POLLUTES ON VEGETATION, RESISTANCE AND SUSCEPTIBILITY OF DIFFERENT PLANT SPECIES IN VARIOUS HABITATS, IN RELATION TO PLANT UTILIZATION FOR SHELTER BELTS AND AS BIOLOGICAL INDICATORS

M. Y. Nuttonson Dec. 1969 108 p refs
(Grant AP-00786-01)
(PB-198062; APTD-0636) Avail: NTIS CSCL 13B

A survey of U.S.S.R. air pollution literature was conducted by the American Institute of Crop Ecology. Effects and symptoms

of air pollutes on vegetation, and resistance and susceptibility of different plant species in various habitats are treated in relation to plant utilization for shelter belts and as biological indicators.
E.M.C.

N71-29834# American Inst. of Crop Ecology, Silver Spring, Md.
AICE SURVEY OF USSR AIR POLLUTION LITERATURE. VOLUME 4. METEOROLOGICAL AND CHEMICAL ASPECTS OF AIR POLLUTION, PROPAGATION AND DISPERSAL OF AIR POLLUTANTS IN A NUMBER OF AREAS IN THE SOVIET UNION
M. Y. Nuttonson Dec. 1969 117 p refs
(Grant AP-00786-01)
(PB-198064; APTD-0838) Avail: NTIS CSCL 13B

A survey of U.S.S.R. air pollution literature was conducted by the American Institute of Crop Ecology. Meteorological and chemical aspects of air pollution are discussed, and dispersal of air pollutants in a number of areas in the Soviet Union is reported.
E.M.C.

N71-29851# Atomic Energy Commission, Washington, D.C. Div. of Reactor Development and Technology.
PROCEEDINGS OF THE ELEVENTH AEC AIR CLEANING CONFERENCE, VOLUME 2
Melvin W. First and James M. Morgan, Jr., eds. Dec. 1970 391 p refs Conf. held at Richland, Wash., 31 Aug.–3 Sep. 1970; sponsored in part by Harvard Univ.
(CONF-700816-Vol-2) Avail: NTIS HC$6.00/MF$0.95

Papers are presented on air cleaning problems associated with liquid metal fast breeder reactors, including accident cleanup systems for the Fast Flux Test Facility. The topics are on advanced energy sources, radioiodine, instrumentation, biological effects, filtration and filters, fire safety, and related topics. For individual titles, see N71-29852 through N71-29881. For Vol. 1, see N71-27976.

N71-29852# Atomic Energy Commission, Washington, D.C.
ENERGY SOURCES OF TOMORROW
W. E. Johnson *In its* Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 459–466 (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

The energy required in the USA in the future to keep the environment habitable for an expanding population and the relation between our environment and energy are discussed. It is concluded that 6 times the present electric energy capacity will be needed by the year 2000 to clean the environment and to maintain a reasonable standard of living for the additional population. Methods must be found for producing, distributing, and both cleanly and economically using fossil fuels. The more efficient breeder reactors must be developed for the economic use of nuclear fuels in commercial power plants. Finally, a nationally coordinated system for planning, developing, constructing, financing, and operating power plants is needed to achieve both the future electric energy needs and the environmental compatibility requirements.
NSA

N71-29853# Idaho Nuclear Corp., Idaho Falls.
HYPOIODOUS ACID: AN AIRBORNE INORGANIC IODINE SPECIES IN STEAM-AIR MIXTURES
J. H. Keller, F. A. Duce, D. T. Pence, and W. J. Maeck *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 467–481 refs (See N71-29851 17-13)
(Contract AT(10-1)-1230)
Avail: NTIS HC$6.00/MF$0.95

Airborne hypoiodous acid is generated by the injection of elemental iodine into a steam–air atmosphere or by purging a dilute aqueous solution of iodine in water with air or other gases. In a water-cooled power reactor, the accident-released fission products will contact a heated water solution at a pH of 7 to 10 and then will transport to a steam–air atmosphere. These conditions seem ideal for the formation and stable existence of hypoiodous acid in the vapor state. Thus, it, rather than methyl iodide, could well be the hazardous species from the biological standpoint. Hypoiodous acid, like methyl iodide, penetrates various adsorbents including silver surfaces commonly used in atmospheric samplers and thus may explain the abnormally high organic fractions reported by other investigators. Hypoiodous acid is important to the spray technology program because its removal rate differs from that of elemental iodine and methyl iodide.
Author (NSA)

N71-29854# Argonne National Lab., Ill.
CHARCOAL TESTING WITH METHYL IODIDE USING A PYROLYZER-MICROCOULOMB DETECTOR
Donald R. McFee and Ralph R. Bechtold *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 482–494 refs Sponsored by AEC (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

The alkyl iodides, especially methyl iodide, are some of the main radio-iodine-containing contaminants that charcoal filters remove from off-gas systems for nuclear fuels. Charcoals showing a high efficiency for removal of methyl iodide can be expected to show a high efficiency for trapping other compounds of iodine. Thus, the high efficiency of a charcoal filter, an absence of leaks, and the overall uniform integrity of a system can be verified through inplace testing with methyl iodide. If, on the other hand, the efficiency for methyl iodide is found to be low, the filter still may prove efficient for other iodine compounds and must be judged on the basis of the compounds it is supposed to remove from the air stream, which may or may not be organic iodides. Tests on other charcoal systems containing old, nonimpregnated charcoal showed penetrations ranging from a few percentage points to greater than 20%.
Author (NSA)

N71-29855# Douglas United Nuclear, Inc., Richland, Wash. Nuclear Safety Technology.
IN PLACE TEST RESULTS OF THE N REACTOR CHARCOAL CONFINEMENT FILTER SYSTEM USING IODINE TAGGED WITH IODINE-131 TRACER
J. E. Mecca and J. D. Ludwick *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 495–525 refs (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

The implementation of in-place testing at the N Reactor is described. A description of the equipment, procedures and results obtained in testing of the charcoal filter confinement systems at the N Reactor initially and subsequently to the present time is presented.
Author (NSA)

N71-29863# Idaho Nuclear Corp., Idaho Falls.
A SELECTIVE ADSORBENT SAMPLING FOR DIFFERENTIATING AIRBORNE IODINE SPECIES
J. H. Keller, F. A. Duce, and W. J. Maeck *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 621–634 refs (See N71-29851 17-13)
(Contract AT(10-1)-1230)
Avail: NTIS HC$6.00/MF$0.95

An atmospheric sampling device capable of differentiating and measuring the various species of airborne iodine under water-reactor accident-release conditions is described. A high-efficiency particulate filter and a series of three inorganic material adsorbents that separate the containment atmosphere sample into four fractions including noniodine particulate, elemental iodine, nonelemental inorganic iodine (hypoiodous acid), and organic iodine. The requirement for an adsorbent for hypoiodous acid is based on the finding that hypoiodous acid, which has a long airborne half-time, is the major inorganic iodine species after the initial washout of elemental iodine from a steam-air atmosphere. Because hypoiodous acid is only partially retained by silver metal surfaces in conventional samplers, it would collect on the charcoal bed resulting in erroneously high values for methyl iodide.
Author (NSA)

N71-29865# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.

DEVELOPMENT OF A CONTINUOUS SAMPLER MONITOR FOR THE LOFT CONTAINMENT ATMOSPHERE

R. E. Schlindler, R. R. Hammer, D. E. Black, and L. T. Lakey *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 653–667 refs (See N71-29851 17-13)

Avail: NTIS HC$6.00/MF$0.95

During the loss of fluid test (LOFT), the continuous Sampler-Monitor (CSM) remotely sample and determines the airborne noble gas, total iodine, and organic iodide concentrations and monitors changes in total activity in the LOFT containment atmosphere. In the CSM, a 2 liter/min. stream of the atmosphere is continuously drawn into a scrubber where the elemental iodine and most of the particulate fission products are washed into a stream of basic-thiosulfate scrubbing solution; the noble gases, organic iodides, and hypoiodous acid remain in the gas stream. The scrubbed gas stream and the scrubbing solution flow in a common line to a sampling station located outside the containment building where they are separated. The gross activity levels of the separated streams are monitored, and samples of each stream are analyzed to determine the concentrations of individual nuclides in the containment atmosphere. In tests conducted with low concentrations of iodine or xenon in an 86 cu ft vessel under simulated loss-of-coolant accident atmospheric conditions, the CSM performed satisfactorily. Author (NSA)

N71-29866# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.

APPLICATION OF THE CONTINUOUS SAMPLER MONITOR (CSM) AS A HAZARD EVALUATION INSTRUMENT

R. J. Schultz *In* AEC Proc. of the 11th Air Cleaning Conf., Vol. 2 Dec. 1970 p 668–682 refs (See N71-29851 17-13)

(Contract AT(10-1)-1230)

Avail: NTIS HC$6.00/MF$0.95

The practical applications of the Continuous Sampler Monitor (CSM) in the Loss of Fluid Test (LOFT) integral test program and the possible use of the CSM in the nuclear power industry are discussed. The unique features that the CSM provides for gathering information concerning the conditions and radioactivity levels in the containment atmosphere following a loss-of-coolant accident are described. These unique features are: whole air sample remotely taken from the containment vessel atmosphere, real time activity profile of airborne fission products, and rapid measurements of activities to below 0.05 microcurie/cu ft of containment atmosphere. In the event of a massive spillage involving radioactive material, loss-of-coolant accident, or any event leading to the release of fission products to the containment atmosphere, the scrubber system can be activated and the sampler used for hazard evaluation. The hardware to be used in LOFT and the adaptations render the instrument usable for industry are also described. Author (NSA)

N71-29867# Southwestern Radiological Health Lab., Las Vegas, Nev.

ANALYSIS OF ATMOSPHERIC GASES

Frederick B. Johns and Richard E. Jaquish *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 683–696 refs (See N71-29851 17-13)

Avail: NTIS HC$6.00/MF$0.95

A variety of air samplers are used in the analysis of radionuclides are discussed. The mixtures of gases are separated using low-temperature adsorption and gas-chromatograph techniques. After separation, the quantity of radioactivity is determined by counting. The gases routinely sampled and analyzed are xenon, water vapor, krypton, carbon dioxide, and radon. Author (NSA)

N71-29871# Royco Instruments, Inc., Menlo Park, Calif.

ATMOSPHERIC PARTICLE PENETRATION THROUGH HIGH FREQUENCY FILTERS

A. Lieberman and R. D. Scott (HEPA Corp.) *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 751–765 refs (See N71-29851 17-13)

Avail: NTIS HC$6.00/MF$0.95

Penetration of atmospheric particles through filters with rated dioctyl phthalate (DOP) removal efficiencies ranging from 90% to 99.97% was studied. Exact data on DOP removal are obtained with a Q76 penetrometer. Atmospheric particle number concentrations were determined in the size ranges 0.3 to 0.5 micrometer; 0.5 to 0.7 micrometer; 0.7 to 1.0 micrometer and 1.0 to 3.0 micrometer, up and downstream of the filters. Relationships between DOP penetration and atmospheric particle penetration are discussed. The effect of variations in filter face velocities is included. Author (NSA)

N71-29872# Naval Research Lab., Washington, D.C.

GOVERNMENT INDUSTRY MEETING ON FILTERS, MEDIA AND MEDIA TESTING

W. L. Anderson *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 766–769 (See N71-29851 17-13)

Avail: NTIS HC$6.00/MF$0.95

The proceedings of the 11th annual government-industry meeting on the development and testing of high efficiency particulate filters are reviewed. The subjects discussed included: military specifications for high efficiency filters; use of special glass fibers; irradiation tests on HEPA materials, development of HF-resistant media; moisture resistance testing, filter media caliper, and penetrometer calibration. NSA

N71-29876# Atomics International, Canoga Park, Calif.

MEASUREMENTS OF PARTICULATE FILTRATION EFFICIENCIES OF BUILDING

C. Nelson, J. Granger, R. Koontz, and L. Baurmash *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 817–823 refs (See N71-29851 17-13)

(Contract AT(04-3)-701)

Avail: NTIS HC$6.00/MF$0.95

The release and transport of effluents generated during hypothetical major liquid metal fast breeder reactor (LMFBR) accidents are being characterized for application to safety and engineering safeguards design, since the doses at the site boundaries are based on the leaked mass of hazardous materials. Experiments and results which show that the airborne mass is considerably reduced as it passes through concrete and other porous materials are described. Experiments indicate that as much as a 100,000 attenuation of sodium oxide aerosol can be expected as it passes through as little as 1-1/2 in. of concrete. Leakage through cracks and capillaires is evaluated experimentally, to show the role of impaction, settling, and diffusion in reducing the leaked mass. Author (NSA)

N71-29887 National Lending Library for Science and Technology, Boston Spa (England).

VERTICAL EXCHANGES OF ARTIFICIAL AEROSOLS IN THE TROPOSPHERE

J. Servant et al 1970 6 p refs Transl. into ENGLISH from Acad. Sci. (Paris), C. R. 268 Ser. B. 1968 p 1686–1688 (NLL-M-9265-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Comparison of the amount of strontium 90 in air and in rainwater from 1963 to 1965 shows that vertical exchanges of air between the ground and the rain forming zone are important in middle latitudes. It is likewise in the polar regions (Greenland) in spring and autumn and in the equatorial regions (Panama Canal) in summer and autumn but remains weak during the rest of the year. Author

N71-29888 National Lending Library for Science and Technology, Boston Spa (England).

VISUAL RANGE VARIATIONS DUE TO MOISTURE GROWTH OF AEROSOLS

Fritz Kasten 24 Jun. 1970 11 p refs Transl. into ENGLISH from Ann. Met. Neue Folge (West Germany), no. 4, 1969 p 148–151

(NLL-M-9267-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The growth of an aerosol particle of radius r with relative humidity f according to measurements is approximated by (dr/r)/df = 1/mu (1-f) where mu = constant. In a natural aerosol having a size distribution according to Junge's equation with the exponent nu *, the corresponding variation of standard visual range V can be described approximately by (dV/V)/df = −(nu*-1)/mu(1-f). With nu* = 3, this expression satisfactorily represents Frankenberger's results. Author

N71-29890# National Weather Service, Silver Spring, Md. Techniques Development Lab.

TWICE-DAILY MEAN MONTHLY HEIGHTS IN THE TROPOSPHERE OVER NORTH AMERICA AND VICINITY

August F. Korte Jun. 1971 34 p refs Sponsored by Dept. of the Interior

(NOAA-TM-NWS-TDL-41) Avail: NTIS

The mean maps show average geopotential metric heights for the 850-, 700-, 500-, and 300-mb pressure surfaces at 0000 and 1200 GMT for each month of the year. The maps were derived by computer from objectively analyzed grid-point data for November 1961 through January 1969. The use of these maps is briefly described to obtain the average monthly height for any day and 12-hour period. Author

N71-29909*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DERIVATION OF THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD[IGRF(10/68)] Revised

Joseph C. Cain and Shirley J. Cain Jul. 1971 37 p refs

(NASA-TM-X-65604; X-645-71-262-Rev.) Avail: NTIS CSCL 08N

Some of the computations are summarized that were made at the International Association of Geomagnetism and Aeronomy symposium in Washington, D.C., October 22nd to 25th, 1968, that led to the resolution to propose an International Geomagnetic Reference Field (IGRF). The basic requirements established called fo the IGRF to consist of no more than 80 spherical harmonic coefficients of internal origin, epoch 1965.0, each being tabulated together with its first time derivative. These coefficients were to represent true spherical harmonics describing the field, not quasi-spherical harmonics resulting from derivations neglecting the oblateness of the earth. The sets of spherical harmonic coefficients are given; each updated to 1965.0 and limited to an n* (maximum degree n and order m of the spherical harmonic coefficients) of eight. Author

N71-29913# Air Force Cambridge Research Labs., Bedford, Mass.

GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 7, NUMBER 4 Quarterly Report, 1 Oct.–31 Dec. 1970

Anne L. Carrigan, ed. Mar. 1971 247 p

(AD-722438; AFCRL-71-0193; QR-4) Avail: NTIS CSCL 3/2

The Bulletin is a quarterly publication that contains AFCRL contract and inhouse data reported from sites throughout the world. Program descriptions for all data sections are updated annually or as required, and are presented in Number 1 of each volume. The following types of data are contained within each issue: magnetometer, cosmic ray, ELF noise, riometer, solar optical and radio emission, and ionosonde. This issue covers such data for October, November, and December 1970. Author (GRA)

N71-30008*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROPERTIES OF LOW-ENERGY PARTICLE IMPACTS IN THE POLAR DOMAIN IN THE DAWN AND DAYSIDE HOURS

R. A. Hoffman Jun. 1971 75 p refs Presented at the Magnetosphere-Ionosphere Interactions Advanced Studies Inst. Conf., Espedalen, Norway, 15–22 Apr. 1971 Submitted for publication

(NASA-TM-X-65593; X-646-71-199) Avail: NTIS CSCL 04A

The electrons in the soft zone produce a large number of interesting phenomena both above and in the ionosphere, such as the generation of VLF hiss, magnetic effects from the currents they constitute, electron concentration enhancement peaks at 1000 km altitudes, and the dayside auroral oval, with emissions predominantly at 6300A. Electron precipitation in this zone is continuously present. On the other hand, fewer phenomena appear associated with the lower latitude hard zone, which exists through the morning hours to noon, and is related to substorm activity. The higher energy precipitating electrons (less than 50 keV) produce D-layer events. The lower energy electrons (a few keV) produce the mantle aurora, but because of a likely energy dispersion from local time drift of the electrons originating in the midnight region, the morphology of E-layer absorption events is more difficult to observe. Author

N71-30007*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INTERPRETATION OF VERTICAL WAVE PATTERNS IN THE WINTER ATMOSPHERE AT HIGH LATITUDES IN TERMS OF GRAVITY WAVE THEORY

Igor J. Eberstein Jun. 1971 18 p refs Submitted for publication

(NASA-TM-X-65605; X-651-71-263) Avail: NTIS CSCL 04A

Temperature data from four rocket soundings were averaged, and a smooth curve was drawn through the points. A hydrostatically determined atmosphere based on the above lapse rate was calculated. Deviations from the above mean atmosphere were calculated, and a wavelike structure was observed. The waves grow very slowly below approximately 80 km, and acquire a more rapid growth rate at higher altitudes. The density and temperature variations have a wavelength of 10–20 km and are 180 degrees out of phase. The pressure variation is somewhat irregular. However, in regions where pressure variation is well behaved it is out of phase with temperature and density by about 90 degrees. Gravity wave theory was used to compute wave patterns like those observed experimentally. A highly damped upward propagating wave gives good results. Turbulence provides the most effective damping mechanism, but it is found that generally expected levels of turbulence are too low to provide the needed damping. Author

N71-30078*# National Aeronautics and Space Administration, Washington, D.C.

AURORAS: COLLECTION OF ARTICLES NO. 17

S. I. Isayev, ed., et al Jun. 1971 248 p refs Transl. into ENGLISH of the book 'Polyarnyye Siyaniya. Sbornik Statey, No. 17' Moscow, Nauka Press, 1968 p 1–165

(NASA-TT-F-637) Avail: NTIS CSCL 04A

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17. MAGNETIC ACTIVITY AT HIGH LATITUDES OF THE NORTHERN HEMISPHERE DURING THE MAXIMUM AND MINIMUM OF THE SOLAR CYCLE R. G. Afonina et al p 203-242 refs (See N71-30093 17-13)

N71-30077*# National Aeronautics and Space Administration, Washington, D.C.

A COMPREHENSIVE INVESTIGATION OF THE POLAR IONOSPHERE

L. S. Yevlashin et al *In its* Auroras Jun. 1971 p 1-27 refs (See N71-30076 17-13)

Avail: NTIS CSCL 04A

Results are presented of vertical sounding and riometer observations of the state of the ionosphere, variations of the earth's magnetic field, and spatial position and spectral intensity of aurora. Specific areas of interest include the spatial connection of ionospheric electric currents and auroral and ionospheric inhomogeneities in the E sub s layer. The frequency dependence of cosmic radio wave absorption and its variations, based on the form of aurora and on the depth of ionizing radiation penetration, are analyzed. The relative intensity of streams of auroral protons and electrons is evaluated and the microstructure of geomagnetic disturbances connected with active and quiet forms of aurora are discussed. Author

N71-30078*# National Aeronautics and Space Administration, Washington, D.C.

THE POLAR AURORAL BAND DURING MAGNETIC DISTURBANCES

G. V. Starkov et al *In its* Auroras Jun. 1971 p 28-47 refs (See N71-30076 17-13)

Avail: NTIS CSCL 04A

According to C-180 askafilms, the position of aurora bands was determined for four time intervals centered at 02, 04, 08, and 16 hours of local geomagnetic time depending on the level of magnetic activity. The indices Q, Qp and Kp were used to characterize magnetic disturbance. Values of changes of the auroral bandwidth at these time intervals with the magnetic activity variations were obtained. At different Q-indices it is shown that an evening-morning asymmetry exists, which is expressed in the different width of the corresponding parts of the land and in the different distances of the latter from the pole. This symmetry is maintained at any level of magnetic activity. A flattening of the aurora band is observed on the day side and is most prominent during high magnetic disturbances. The aurora band during low magnetic activity can have breaks on the morning and evening sides. The probability of such breaks is reduced with the increase of magnetic disturbance and their presence is supported by synoptic maps. Author

N71-30079*# National Aeronautics and Space Administration, Washington, D.C.

U-LIKE POLAR AURORAL SHAPES

S. A. Zaytseva *In its* Auroras Jun. 1971 p 48-55(See N71-30076 17-13)

Avail: NTIS CSCL 04A

The peculiarities of excitation and development of U-like auroral bands and their connection with the level of magnetic activity and configuration of current systems in the lower ionosphere are discussed. Analysis of all-sky photographs yields the following conclusions: (1) The appearance of a U-like shape is statistically related to the zero transition amount of the H component of the S sub D geomagnetic field variation. (2) Despite the time relationship between this shape and the S sub D current system, the assumption that these currents flow along the U-like shape is erroneous. (3) The emergence of the shape at pre-midnight hours, when K sub p is large, can be explained by the formation of magnetospheric convection vortexes. The deformation is apparently caused by the positive charge formed in the ionosphere on the earth's night side. Author

N71-30080*# National Aeronautics and Space Administration, Washington, D.C.

THE EFFECT OF MAGNETIC ACTIVITY UPON AURORAL HEIGHTS

G. V. Starkov *In its* Auroras Jun. 1971 p 56-62 refs (See N71-30076 17-13)

Avail: NTIS CSCL 04A

Auroral height data are analyzed to determine the effect of magnetic activity on observed variations. Results indicate that the auroral heights diminish with the increase of magnetic activity. The increase of the vertical stretch with the decrease of magnetic activity is observed for ray forms. The dependence is obtained between the energy of electrons, corresponding to the average value of height of the lower edge of aurora, on the magnitude of the K sub p index. Author

N71-30081*# National Aeronautics and Space Administration, Washington, D.C.

AURORAL PULSATIONS

V. K. Roldugin *In its* Auroras Jun. 1971 p 63-71 refs (See N71-30076 17-13)

Avail: NTIS CSCL 04A

Analyses of photometric recordings of ionospheric data are presented which indicate that auroral pulsations of the P sub i1 type, unlike P sub i 2, are caused not by variations of arcs and bands, but by the surrounding background. The diurnal changes of the former pulsation intensities differ from the diurnal changes of auroral intensity. Pulsations were observed in the infrared region which were not accompanied by the glow in the visible region of the spectrum. A conclusion is made about the different mechanisms causing pulsating and non-pulsating auroral forms. Author

N71-30082*# National Aeronautics and Space Administration, Washington, D.C.
POLAR AURORA AT THE MINIMUM OR MAXIMUM CYCLE OF SOLAR ACTIVITY
Ya. I. Feldshteyn et al *In its* Auroras Jun. 1971 p 72-86 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

A comparison of auroras in the years of the maximum (GY) and minimum (IQSY) cycle of solar activity is presented. It was found that: (1) Although the level of solar activity has greatly reduced nightside auroras on the latitude of the oval auroral zone continue to appear practically without interval. (2) The central line of the oval zone during the years of the minimum has only slightly shifted in the night hours towards the pole. (3) With planetary magnetic disturbances relatively similar in intensity, the region of latitudes covered by auroras on the nightside in the years of the maximum is smaller than in those of the minimum. (4) Certain statistical regularities in aurora are in good correlation with the oval form of the auroral zone during the IQSY period. This form is analogous to that suggested earlier for the IGY period. Author

N71-30083*# National Aeronautics and Space Administration, Washington, D.C.
THE RATIO OF 1 NGO2(+) AND 1 PGN2 EMISSIONS AS A FUNCTION OF AURORAL HEIGHT
V. K. Roldugin *In its* Auroras Jun. 1971 p 87-89 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

Scanning photometer data of auroral emission zones are presented and compared with height measurements. It is found that the change of ratio of 1 NGO(+)2 emissions, registered scanning photometer, to 1 PGN-2 has the same form, depending on the height of aurora, as the change of concentration ratio N(O2) to N(N2) in the atmosphere. Author

N71-30084*# National Aeronautics and Space Adminstration, Washington D.C.
IONOSPHERIC PROCESSES ASSOCIATED WITH AURORAL HEIGHT VARIATIONS
P. Ye Sukhoivanenko *In its* Auroras Jun. 1971 p 90-95 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

A comparison is made of the height of aurora during several hours in March 1965 with emission intensity of 4278 A, radio wave absorption at a frequency of 32 Mhz, and earth current pulsations. Author

N71-30085*# National Aeronautics and Space Administration, Washington, D.C.
THE EFFECT OF QUASI-RHYTHMICITY IN GEOMAGNETIC AND AERONOMIC PHENOMENA
G. P. Tsirs *In its* Auroras Jun. 1971 p 96-116 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

Periodic variations observed ultralow frequency and ultrahigh frequency emmissions, bursts of geomagnetic disturbances, and auroral absorption bursts are discussed. Riometer data on these phenomena often indicate successions, or quasi-rhythmic characteristics, so that the greatest ratio of the neighboring tact intervals (TI) between the beginning of the bursts is within 1.00 - 1.12, or 1.38 - 1.74. An analysis is made of the reciprocal relationship of consecutive TI, and an interpretation of the physical meaning of the phenomena is offered. Author

N71-30086*# National Aeronautics and Space Administration, Washington, D.C.
THE ENERGY BALANCE OF A MAGENTIC STORM
B. Ye Bryunelli et al *In its* Auroras Jun. 1971 p 117 127 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

The total energy and dissipation rate at different stages of magnetic storm development are analyzed. Evaluations are made of the energy expenditure of the solar corpuscular stream, associated with the formation of current systems in the magnetosphere of the earth and beyond. Author

N71-30087*# National Aeronautics and Space Administration, Washington, D.C.
QUIET SOLAR DAY VARIATIONS OF THE GEOMAGNETIC FIELD DURING THE IGY. 4: VARIATIONS AT HIGH LATITUDES
A. N. Zaytsev et al *In its* Auroras Jun. 1971 p 128-145 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

High latitude magnetic variations on exceptionally quiet days of the IGY winter and summer seasons are analyzed. The form and amplitude of the variations indicate a close relation between S (sub q) (O) of high latitudes and S (sub q) variations in middle and low latitudes. The magnitude and direction of the variation vector S (sub q) (P) + DP are calculated for five international magneto-quiet days of the IGY summer season for observatories located in the American Euro-Asian longitude sectors. Improved statistics for the magnitude of the excluded component of the variation field S (sub q) (O) were determined from midnight values. The current system S (sub q) (p) and its variation are also illustrated for these five days. Its direction is counterclockwise and corresponds to the closed circulation of matter on the boundary of the magnetosphere around a neutral line. The statistical current system S (sub q) (p) is confirmed by the distribution of the variation field at separate hours of Universal Time. Author

N71-30088*# National Aeronautics and Space Administration, Washington, D.C.
GEOMAGNETIC DISTURBANCES AT HIGH LATITUDES, JUNE 1965
I. A. Kuzmin et al *In its* Auroras Jun. 1971 p 146 160 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

Results are presented of electron currents, precipitating into the lower ionosphere, which are registered by the decelerating X-ray emission with ballon counters, and of their relations with geomagnetic disturbances and riometric absorption. The spatial connection of the region of electron precipitation with the electric currents in the ionosphere and with the region of anomalous absorption is discussed. Two types of electron precipitation, associated with quiet and active forms of aurora, are treated. Author

N71-30089*# National Aeronautics and Space Administration, Washington, D.C.
DYNAMICS OF MAGNETO-IONOSPHERIC DISTURBANCES IN THE POLAR AURORAL ZONE
G. A. Loginov et al *In its* Auroras Jun. 1971 p 161 168 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

The connection between magneto-ionospheric disturbances observed in Murmansk in daytime with the corresponding phenomena in Alaska are analyzed. It is shown that the legging time of disturbances in Murmansk relative to those in Alaska is different for absorption bays and for bays in the geomagnetic field. The regions of enhanced ionization and the electric currents in the ionosphere therefore may not coincide spatially. Author

N71-30090*# National Aeronautics and Space Administration, Washington, D.C.
LATITUDINAL VARIABILITY OF IONOSPHERIC PARAMETERS

A. P. Kolobova et al *In its* Auroras Jun. 1971 p 169–185 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

Data from ionospheric stations in Murmansk, Rugozero and Leningrad for 1962-1963 are analyzed. The critical frequencies of the regular layers at these stations during the day change in accordance with the change of the zenith distance of the sun and increase with the decrease of latitude. In night time, the f(sub O)F2 variations are less regular than during the day; the inhomogeneity of the ionosphere increases and the ionization changes irregularly in the E level as well as the radiowave absorption. The E sub s layer of the r-type in the auroral zone is caused by corpuscular radiation. The energy spectrum of particles causing this layer, is wide, and as the latitude decreases it becomes narrower. The number of occurrences of E sub s of the f type increases with the decrease of latitude. During ionospheric magnetic disturbances, phenomena typical of the auroral zone are observed at lower latitudes and shift in the E and F layers to lower altitudes than in the D layer. Author

N71-30091*# National Aeronautics and Space Administration, Washington, D.C.
HIGH ALTITUDE VELOCITY DISTRIBUTION OF IONOSPHERIC DRIFT AND STRENGTH OF THE ELECTRIC FIELD IN THE F2 LAYER
R. S. Sadobnikova *In its* Auroras Jun. 1971 p 186–192 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

The dependence of the velocity of ionospheric dirfts in the auroral zone on height is discussed. With the increase of height, the drift velocity diminishes. As the drift in the F2 region is carried out mainly under the effect of the electrostatic fields perpendicular to the geomagnetic field, it is concluded that the electric field is formed in the dynamo-region. Evaluations of the strength of the electric field at the height of 200 km are presented, as well as the sizes of inhomogeneities causing the creation of the electric field which brings about the drifts in the F region. Author

N71-30092*# National Aeronautics and Space Administration, Washington, D.C.
PROBLEMS OF AURORAL ABSORPTION
O. I. Shumilov *In its* Auroras Jun 1971 p 193–202 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

Riometer auroral absorption data are analyzed for the period December 1963 – December 1964 at the Loparskaya station, located at 68 deg 37 min latitude and 35 deg 17 min longitide. The relationships between previously identified auroral absorption subtypes are established. The diurnal pattern of changes in the ionizing agent intensity appears to be responsible for the diurnal changes in form for individual cases of absorption. Author

N71-30093*# National Aeronautics and Space Administration, Washington, D.C.
MAGNETIC ACTIVITY AT HIGH LATITUDES OF THE NORTHERN HEMISPHERE DURING THE MAXIMUM AND MINIMUM OF THE SOLAR CYCLE
R. G. Afonina et al *In its* Auroras Jun. 1971 p 203–242 refs (See N71-30076 17-13)
Avail: NTIS CSCL 04A

The space-time distribution of geomagnetic disturbance intensity during IGY-IQSY periods is analyzed. Equivalent ranges of K-indices obtained from high latitude Northern Hemisphere observatories are utilized to determine the main regularities in activity at these 1 atitudes. The following results are obtained: (1) At > or = 70 deg, magnetic activity remains at a high level in the years of minimum and maximum solar activity. (2) The region of maximum values in the coordinate system, corrected geomagnetic latitude -- geomagnetic time, is of an oval form, located in higher latitudes by day and in lower ones at night. (3) With the increase of K sub p the region of the maximum disturbance is removed to the lower latitudes, but in all cases it preserved an oval form. The displacement of the oval of the maximum magnetic disturbances agrees well with the dynamics of the auroral belt. Author

N71-30094*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRIC FIELDS IN THE IONOSPHERE AND MAGNETOSPHERE
Nelson C. Maynard Jun. 1971 42 p refs
(NASA-TM-X-65596; X-645-71-231) Avail: NTIS CSCL 04A

Techniques for measuring ionospheric and magnetospheric electric fields and existing measurements are reviewed. Considerable progress in understanding electric fields was made in the auroral regions where fields originating basically from convection patterns in the magnetosphere and modified by ionospheric interaction were detected by both the barium ion cloud and double floating probe techniques and compared against predictions. The anticorrelation of electric fields and auroral arcs, the establishment of the auroral electrojet currents as Hall currents, the irregular nature of the electric fields, and the reversal of the electric fields between the eastward and westward electrojet regions are included. Convection across the polar cap is anti-sunward. Measurements of dc electric fields at lower latitudes are much more sparse and show agreement and disagreement with Sq dynamo electric field predictions. Variational effects in the electric fields were found wherever strong fields exist. Both electrostatic and electromagnetic phenomena were detected looking at the ac components. Author

N71-30139*# Alaska Univ., College. Geophysical Inst.
ANALYSIS OF DATA ACQUIRED ON THE 1968 AIRBORNE AURORAL EXPEDITION Final Report, 1 Aug. 1968–30 Jun. 1970
Gerald J. Romick 1970 50 p refs
(Grant NGR-02-001-048)
(NASA-CR-119185) Avail: NTIS CSCL 03B

The analysis of data from both the 1968 and 1969 NASA Airborne Expeditions covers general areas of spectral variability of both aurora and airglow emissions in a wide range of latitudes and longtidues. It is found that: (1) the ratio of wavelength4278 N2(+)/wavelength5577 seems to be constant across at least one discrete auroral form, (2) the wavelength5001 to wavelength5006 N II emissions appear to be due to direct dissociation ionization and excitation of N2, and (3) the mid-day sector of the auroral oval and polar cap shows zones of electron precipitation (as deduced from the wavelength8300/wavelength4278 ratios with latitude). Author

N71-30148*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
TAER WIND CONVERSION PROGRAM (TARWON) USER'S MANUAL
John E. Tyson May 1971 134 p refs
(Contract NAS8-26128)
(NASA-CR-119176; HREC-6128-1; LMSC-HREC-D225043) Avail: NTIS CSCL 04A

A method was developed by which a computer program is used to reduce the number of tapes required for storing data. The method converts all 0.1-second raw FPS-16/Jimsphere radar tracking Time, Azimuth, Elevation and slant Range (TAER) data to 1-second velocity component data using editing and low-pass filtering techniques. The new 1-second velocity data contain all the useful information present in the 0.1-second TAER data with an added benefit of a 90% reduction in the number of computer tapes required for storage. The necessary information is presented for using the TAER Wind Conversion program (TARWON) to

convert raw FPS-16 radar tracking data of the Jimsphere balloon to smoothed, 1-second velocity component data. TARWON converts the 0.1-second position coordinates to 0.1-second values of meridional, zonal, and vertical components of the balloon's velocity. The TARWON program is primarily designed to be operational on the NASA-MSFC Univac 1108, Exec 8 computing system, but with little effort, its operation can be extended to other computing systems. Included in the user's manual is the mathematical model, general program description, input guide, derivation of the equations used in linear curve fitting, program listing, and a sample data case illustrating both program input and output. Author

N71-30176# Grumman Aerospace Corp., Bethpage, N.Y. Geo-Astrophysics Section.

AUTOMATED DELINEATION OF WETLANDS IN PHOTOGRAPHIC REMOTE SENSING

Walter G. Egan and Malcolm E. Hair (Adelphi Univ.) Jun. 1971 24 p refs Presented at the 7th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 17–21 May 1971

(RM-509J) Avail: NTIS

Precision automated photometric mapping of wetlands in Calvert County, Maryland, has been achieved in an operational system as the result of a program including aerial color film (both true color and false color infrared) calibration and control. Although the system was operated over this area, it may be adapted to other areas. The recognition appears to be most accurately achieved by microdensitometer analysis of the true color transparency in a narrow band centered in the red (0.633 micrometer, on 3000-foot altitude imagery. A computer-generated map is presented. Author

N71-30177*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A COMPARATIVE GEOLOGIC STUDY OF SPACECRAFT AND AIRCRAFT IMAGERY

H. W. Blodget May 1971 62 p refs

(NASA-TM-X-65594; X-644-71-204) Avail: NTIS CSCL 08G

A comparative study of five areas of northwest Saudi Arabia was conducted using five scales (1:18 million to 1:60,000) and types of imagery, and employing standard photo interpretation techniques. Results indicate that each type imagery is uniquely suited for investigation of a specific class of geologic problem. For study of small geologic detail and construction of precise maps, aerial photography is unexcelled. Mosiacs permit extrapolation of inferences from individual photographs to larger areas, but with loss of detail. Orbital color photography appears to combine many advantages of mosaics and air photographs, for despite its low ground resolution, it is clearly valuable for studying regions of subcontinental size. When rectified, resolution on synoptic photographs is degraded, but the resultant near-vertical projection enables more accurate correlation of data between the unrectified photography and standard geologic map formats. Orbital scan-type imagery has very low ground resolution and may not be directly useful in geologic research. It does, however, provide a useful view of continental and intercontinental structural relationships. Author

N71-30201# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

SATELLITE COSMOS-261 STUDY OF GEOACTIVE CORPUSCLES AND PHOTOELECTRONS. PART 1: EXPERIMENT DESCRIPTION

A. D. Bolyunova, M. L. Bracin, Y. I. Galperin, V. A. Gladyshev, N. V. Jorgio et al Sep. 1969 13 p

(PR-8-Pt-1) Avail: NTIS

An experiment for measuring geoactive low energy particles and photoelectrons and their interactions with the upper atmosphere is described. For the experiment coordinated measurements from the Cosmos-261 satellite (December 1968–February 1969), and simultaneous observations of geophysical disturbances were conducted in the USSR and other socialist countries. ESRO

N71-30202# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

SATELLITE COSMOS-261 STUDY OF GEOACTIVE CORPUSCLES AND PHOTOELECTRONS. PART 2: MEASUREMENTS OF LOW-ENERGY ELECTRONS

Y. I. Galperin, N. V. Jorjio, L. D. Ivanov, I. P. Karpinsky, E. L. Lein et al Sep. 1969 37 p refs

(PR-7-Pt-1) Avail: NTIS

The low-energy electron spectrometer for electron counting in the energy range from 30 to 15 keV is described. Results of measurements with the spectrometer made from Cosmos-261 are given. ESRO

N71-30203# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

SATELLITE COSMOS-261 STUDY OF GEOACTIVE CORPUSCLES AND PHOTOELECTRONS. PART 3: MEASUREMENT OF LOW-ENERGY IONS

Y. I. Galperin, V. A. Gladyshev, I. D. Ivanov, I. P. Karpinsky, B. I. Khasanov et al Sep. 1969 20 p refs

(PR-8-Pt-3) Avail: NTIS

The low-energy ion trap spectrometer RIP-801 used on Cosmos-261 for ions from 0.04 to 8 keV is described. It consists of a modulation trap with magnetic shielding of the ring collector which eliminates secondary currents and photoelectrons from the collector to body. The results of Cosmos-261 measurements are given. ESRO

N71-30204# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

SATELLITE COSMOS-261 STUDY OF GEOACTIVE CORPUSCLES AND PHOTOELECTRONS. PART 4: MEASUREMENTS OF MIDDLE- AND HIGH-ENERGY CHARGED PARTICLES

A. D. Bolyunova, Y. I. Galperin, L. S. Gorn, I. D. Ivanov, R. N. Isaieva et al Sep. 1969 28 p refs

(PR-9-Pt-4) Avail: NTIS

The medium energy range scintillation electron spectrometer RIE-205, scintillation proton spectrometer RIP-802, and lead-shielded Geiger counter RIG-111 used on Cosmos-261, are described. Energy spectra of electrons and protons, their pitch-distributions and space-time characteristics were measured in the radiation belts and auroral regions. Some sample results are shown. ESRO

N71-30233*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POSSIBLE EFFECTS OF LATENT HEAT RELEASE IN THE TROPOSPHERE ON THE VERTICAL TEMPERATURE STRUCTURE IN THE MESOSPHERE

Igor J. Eberstein and J. S. Theon Mar. 1971 12 p refs

(NASA-TM-X-65592; X-650-71-196) Avail: NTIS CSCL 04A

The nonperiodic generating mechanisms involved in meterological sounding of the structure of the mesosphere, are investigated. The irregular features involved include warm and cold layers caused by latent heat release in the troposphere. A linearized solution to the chemically generated waves in dilute isothermal atmosphere is used in the calculations. The temperature profiles computed from theory compare favorably with observations. E.H.W.

N71-30247*# Scientific Translation Service, Santa Barbara, Calif.

VELOCITY OF LONGITUDINAL WAVES AND ELASTIC MODULUS OF DRY AND SATURATED SEDIMENTARY

ROCKS [DIE GESCHWINDIGKEIT VON LONGITUDINALWELLEN UND DER ELASTIZITAETSMODUL VON TROCKENEN UND GESAETTIGTEN SEDIMENTGESTEINEN]
J. Schoen Washington NASA Jul. 1971 7 p refs Transl. into ENGLISH from Proc. of 1st Congr. of Intern. Soc. of Rock Mech., Lisbon, 25 Sep. - 1 Oct. 1966 Lisbon, Lab. Nac. Eng. Civil, 1966 p 21 - 23
(Contract NASw-2035)
(NASA-TT-F-13749) Avail: NTIS CSCL 08G

From the theory of Biot the author has computed curves to determine the elastic modulus of a saturated sandstone when the modulus of dry sandstone is known. Some examples show a good agreement between the measured and computed values. Author

N71-30280*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE P'(f) TO N(h) INVERSION PROBLEM IN IONOSPHERIC SOUNDINGS
John E. Jackson May 1971 45 p refs
(NASA-TM-X-65591; X-625-71-186) Avail: NTIS CSCL 03B

The inversion techniques are reviewed which are used to derive the ionospheric electron density N as a function of altitude h from group path P prime versus frequency f measurements obtained by vertical incidence ionospheric sounders. The medium under investigation, the experimental techniques used to obtain the P prime (f) data, the theoretical considerations which lead to the integral equation relating P prime (f) to N(h), and the assumptions made in the inversion process are discussed. The lamination inversion technique is then presented, with special attention given to mathematical difficulties arising from discontinuities in the P prime (f) function, infinities in the integrand, and in some cases unknown integration limits. Methods are outlined for minimizing the uncertainties due to discontinuities. Author

N71-30273*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IONOSPHERIC PLASMA RESONANCES: TIME DURATIONS VERSUS LATITUDE, ALTITUDE, AND fN/fH
Robert F. Benson Jun. 1971 56 p refs Presented at the URSI-IUPAP Symp. on Waves and Resonances in Plasmas, St. John's, Newfoundland, 5 - 9 Jul. 1971
(NASA-TM-X-65601; X-621-71-253) Avail: NTIS CSCL 04A

The variation of resonant time duration with latitude, altitude, and fN/fH has been determined for the plasma resonances observed by Alouette 1 and Alouette 2 at the electron plasma frequency fN, the electron cyclotron frequency fH, the upper hybrid frequency fT, and the harmonics nfH. The duration of the fN resonance was found to be critically dependent on the transmitted power; long duration fN resonances can be excited with a transmitted sounder power as low as approximately 0.5 W. The 2fH resonance is the only nfH resonance that does not show a definite dependence of duration on latitude and the only one that shows a strong dependence on fN/fH; the other nfH resonances show a definite dependence on altitude (as well as latitude). The resonances at 3fH and 4fH are observed strongest at high altitudes whereas the high order harmonics are consistently observed only at low altitudes. The nfH observations with $n > 5$ indicate a stationary resonant region, extending only about 2 meters from the antenna, that is observed during its full time decay period in low latitudes. It is suggested that the high order nfH responses may be the result of the decay of an instability in the turbulent plasma caused by the high power sounder pulse. Author

N71-30294# National Science Foundation, Washington, D.C. National Science Board
ENVIRONMENTAL SCIENCE: CHALLENGE FOR THE SEVENTIES Report of The National Science Board
1971 68 p refs
Avail: SOD $0.40

A study is presented on all the environment surrounding man, the problems existing today and those predicted for the future, and areas for action with respect to those problems. It is pointed out that notable advances have recently been made in environmental science, and its tools and techniques. However the principal conclusion is that environmental science today is unable to match the needs of society for definitive information, predictive capability, and the analysis of environmental systems. It is recommended that the urgency of a comprehensive national program be recognized, early consideration be given to the determination of priorities, the Federal responsibility in organizing and supporting the national program be considered as important as its responsibility for environmental quality, funding for the program and facilities be ensured, and the disciplinary strength of academic institutions be increased in the field of environmental science. N.E.N.

N71-30394# Environmental Data Service, Silver Spring, Md.
HIGHLIGHTS, NATIONAL OCEANOGRAPHIC DATA CENTER, 1961 - 1970
Dec. 1970 48 p refs
Avail: SOD $0.60

The organization, facilities, data processing, data acquisition programs, and services of the center are highlighted. The past development, present operations, and plans for increasing services in the future are covered. N.E.N.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-29233*# California Univ., Berkeley. Forestry Remote Sensing Lab.
THE APPLICATION OF HIGH ALTITUDE PHOTOGRAPHY FOR VEGETATION RESOURCE INVENTORIES IN SOUTHEASTERN ARIZONA Final Report
Lawrence R. Pettinger, Charles E. Poulton (Oregon State Univ.) et al 31 Dec. 1970 153 p refs
(Contract NAS9-9577)
(NASA-CR-115056) Avail: NTIS CSCL 14E

The potential usefulness of Apollo 9 space photography and sequential high altitude NASA aircraft photography for evaluating natural and cultural resources in southeastern Arizona are reported. Techniques for estimating agricultural crop acreage were developed for Maricopa County, an area containing over 500,000 acres of cropland. Major aspects of the study included: collection and use of accurate ground data; determination of the optimum film-filter combination and photo dates for identifying particular crops; performance of photointerpretation over a large geographic area; adjustment of survey estimates; and evaluation of survey results in light of user requirements. In addition, a descriptive legend system is detailed for mapping native vegetation, macrorelief and landforms. The application of this legend system has resulted in the preparation of a map of "Natural Vegetation Resources, Agricultural and Urban Land Use" of a large portion of Maricopa County, Arizona. A copy of this map is included. Author

N71-29262 National Lending Library for Science and Technology, Boston Spa (England).
THE SIX CHANNEL SOLAR MAGNETOGRAPH OF THE PULKOVA OBSERVATORY [SHESTIKANALNYI SOLNECHNYI MAGNITOGRAF PULKOVSKOI OBSERVATORII]
R. N. Ikhsanov et al Dec. 1970 50 p refs Transl. into ENGLISH

from Izv. Galvnoi Astron. Observ. (Pulkovo), no. 185, 1970 p 132–158
(NLL-RTS-6096) Avail: Natl. Lending Library, Boston Spa, Engl.: £4.80; 16 NLL photocopy coupons

A description is given of a new magnetograph which provides direct, simultaneous information on the polarization in lines investigated in the stokes parameters and azimuth. In addition, it provides a record of radial velocity and brightness in the continuous spectrum. The theory of the magnetograph is examined, both as a transfer of radiation polarized in mutually orthogonal directions and in the Stokes parameters. Four types of brightness estimation are considered, and the magnetograph construction and circuitry are described in detail. A new photometer design is attached to the spectrograph as a cassette, and the use of one photomultiplier instead of two simplifies the magnetograph. Problems of field measurement and calibration are treated, as well as estimates of noise at maximum amplitude with a specific spectrograph entrance slit, azimuth channel noise, and brightness channel. Author

N71-29277# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
INVESTIGATION OF A REMOTE TEMPERATURE SENSOR FOR CUTTING TOOLS
J. D. Hensley and R. L. Williams 5 Apr. 1971 6 p
(Contract W-7405-eng-26)
(Y-DA-4088) Avail: NTIS

Development and testing of a remote sensing technique for determining temperatures encountered in metal cutting and its possible application to an adaptive control project are discussed, along with an evaluation of initial development results. Efforts involve use of two remote iron-constantan thermocouples to determine the cutting edge temperature through computerized analysis of the signals generated by the thermocouple junctions. The ultimate goal is to correlate this temperature and tool-wear effects to aid in producing better quality parts. Although testing conditions were limited, the evaluated finish cut conditions were satisfactory for application to the adaptive control project under consideration. A.C.R.

N71-29319*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INSTRUMENTATION AND COMMUNICATION RESEARCH AT MSFC. VOLUME 4: RESEARCH ACHIEVEMENTS REVIEW
May 1971 74 p refs
(NASA-TM-X-64572; Rept-3) Avail: NTIS CSCL 14B

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1. X-RAY SOURCE FOR GRAZING INCIDENCE MIRROR TEST C. T. Jones p 3–9 ref (See N71-29320 17-11)
2. A DIGITAL PRESSURE TRANSDUCER H. S. Harman p 11–18 (See N71-29321 17-14)
3. INVESTIGATION OF DATA COMPRESSION TECHNIQUES W. E. Maynard p 19–30 refs (See N71-29322 17-08)
4. AM BASEBAND TELEMETRY TECHNIQUES J. J. Clubb p 31–41 (See N71-29323 17-07)
5. HIGH STABILITY FM TV TRANSMITTER WITH SAMPLED AUTOMATIC FREQUENCY CONTROL M. A. Honnell p 43–50 refs (See N71-29324 17-07)
6. SPACE STATION RF HAZARDS R. A. Inman p 51–55 refs (See N71-29325 17-04)
7. TELEVISION RESEARCH C. T. Huggins p 57–65 refs (See N71-29326 17-07)

N71-29321*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A DIGITAL PRESSURE TRANSDUCER
H. S. Harman *In its* Instrumentation and Commun. Res. At MSFC, Vol. 4 May 1971 p 11–18 (See N71-29319 17-14)
Avail: NTIS CSCL 14B

A digital pressure transducer, its operational features, and its performance against guideline specifications are discussed. Performance meeting the guideline specifications was achieved. It is designed for spacecraft application. Author

N71-29357*# California Univ., Berkeley.
QUANTITATIVE EVALUATION OF MULTIBAND PHOTOGRAPHIC TECHNIQUES Final Report
Donald T. Lauer, Claire M. Hay, and Andrew S. Benson 31 Dec. 1970 115 p refs
(Contract NAS9-9577)
(NASA-CR-115055) Avail: NTIS CSCL 14E

The usefulness of multiband photography was investigated using environmental parameters within five test sites located in California and Arizona. These included agricultural crop types, forest vegetation types, and tree species composition because of the importance of this analysis to agriculturalists and foresters. Quantitative analyses were made of the interpretability of multiband black-and-white photos viewed separately, multiband black-and-white photos combined into true and false color composites, and color and color infrared photos obtained simultaneously with the multiband black-and-white photography. In each of these case studies, test results indicated that multiband photography consistently yielded higher interpretation accuracies than any type of single band photography. In addition, black-and-white multiband photos properly procured and displayed as false-color composite imagery in all cases rendered as much (or as little) information as conventional triemulsion layer color or false-color infrared films. Author

N71-29399# Battelle Inst., Frankfurt am Main (West Germany).
SURVEY OF POSSIBILITIES OF NONMECHANICAL MODULATION OF INFRARED RADIATION AND CONSIDERATION OF THEIR USEFULNESS FOR SATELLITE APPLICATION
F. K. Dolezalek and H. Jaeger Paris ESRO Oct. 1970 69 p refs
(Contract ESTEC-990/70-AA)
(ESRO-CR-26) Avail: NTIS

Various means of modulating infrared radiation nonmechanically are surveyed and are assessed as regards space application. The likelihood of developing true solid-state modulators suitable for the modulation of IR radiation and applicable to IR horizon sensors does not look promising, but the possible use of a Fabry-Perot etalon is more hopeful. The modulation principle involved is that of a gap in the etalon which is varied in width piezoelectrically. This solution seems likely to provide good modulation depth with only moderately severe engineering requirements. Author (ESRO)

N71-29484# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF FREQUENCY-CONTRAST CHARACTERISTICS OF MOTION PICTURE FILMS
K. V. Vendrovskiy et al 28 Jan. 1971 72 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 6, 1970 p 18–24
(AD-722304; FTD-MT-24-294-70) Avail: NTIS CSCL 14/5

An accelerated method has been developed of measuring the frequency contrast characteristics (ChKKh) of photographic materials on the basis of semi-automatic conversion of sample transmission factors into effective exposures. An economical test-object has been made for measuring the ChKKh of movie photographic materials, adequate for the exposure process in the mass-produced resolvometer. Author (GRA)

N71-29520# Battelle-Northwest, Richland, Wash.
[TISSUE EQUIVALENT PROPORTIONAL COUNTERS IN THIN NEUTRON SHIELD STUDIES]

1970 10 p refs Presented at Meeting on Neutron Sources and Appl., Augusta, Ga. Sponsored by AEC
(BNWL-SA-3561; Conf-710402-1) Avail: NTIS

Rossi tissue-equivalent proportional detectors are described, and their ability to distinguish between neutrons and gamma radiation is discussed. Neutron shielding measurements using Rossi detectors are presented, and LET and quality factor analysis using Rossi detectors are discussed. Relations between dose, dose equivalent, kerma, LET, RBE and quality factor are considered. In summary, the ability of the tissue equivalent proportional counter to make absolute neutron dose measurements in a tissue equivalent system is demonstrated. NSA

N71-29545# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.

MEASUREMENT OF THE CONTAMINATION OF RADIOGENIC ARGON WITH ATMOSPHERIC ARGON BY SCINTILLATION SPECTROMETRY

A. Danis and A. Iorgulescu 1970 6 p refs
(IFA-MR-33) Avail: AEC Depository Libraries

The possibility of the air contamination measurement by neutron activation analysis using scintillation spectrometry was investigated. Preparation of the counter vial and the shape of Ar-37 spectrum are shown. Author (NSA)

N71-29558# National Bureau of Standards, Washington, D.C. Microwave and Mechanical Instrumentation Section.

A NEW DETECTOR UNIT FOR THE 1967 CABLE FAULT LOCATOR

David Brenner 8 Oct. 1970 64 p refs Sponsored by Naval Air Systems Command Supplement to NBS-9886
(NBS-10354; NBS-9886-Suppl) Avail: NTIS

A prototype cable fault locator was constructed in 1967 consisting of a test signal oscillator and a detector unit. Together the two items form a hand-carried instrument which detects ac electrical current in underground cables. A modified version of the detector unit has since been constructed and a description of the improved unit is given. In addition to improving selectivity on the narrowband ranges, a wideband range was added. Also, the audio power delivered to the headphones and the maximum voltage gain of the detector unit were reduced. Author

N71-29679*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NASA OPTICAL INSTRUMENTATION

Kenneth H. Crumbly *In its* Barium Releases at Altitudes between 200 and 1000 km 1971 p 69 73 (See N71-29671 17-13)
Avail: NTIS CSCL 14B

The location of six sites which were operated for each mission is given along with a description of the optical instrumentation at each site. The weather observational conditions for the Javelin and Nike-Tomahawk sounding flights are reviewed, and the data collected from the flights are summarized. F.O.S.

N71-29689# Technische Univ., Berlin (West Germany). Fakultaet fuer Electrotechnik.

ELECTRO-OPTICAL SECOND MAGNIFICATION FOR OPTIMAL POST-ACCELERATION CONDITIONS IN OSCILLATOR TUBES [HOECHSTE NACHBESCHLEUNIGUNGSVERHAELTNISSE IN OSZILLOGRAPHENROEHREN DURCH EINE ELEKTRONENOPTISCHE NACHVERGROESSERUNG]

Klaus Schaffernicht (Ph.D. Thesis) 1969 69 p refs In GERMAN
Avail: NTIS

Post-acceleration of the refracted beam provides oscillator tubes with faster images and single rapid impulses because it increases printing velocity as well as deflection sensitivity. Electro-optical magnification of the beam with reflection reversal by immersion lens increases overall accelerating voltage in the tube to the optimal limit; optimal post-acceleration conditions provide deflection factors of 2 V/cm and 4 V/cm at a bandwidth of 350 MHz for a nondivided deflection system. Transl. by G.G.

N71-29744# Research Triangle Inst., Durham, N.C.

CHEMILUMINESCENT OZONE METER FOR CONTINUOUS AIR MONITORING PROJECT: INSTRUCTION MANUAL Final Report

J. B. Tommerdahl, R. B. Strong, and A. H. Truckner Jan. 1971 86 p refs
(Contract CPA-70-27)
(PB-198065; APTD-0634) Avail: NTIS CSCL 14B

The report describes the results of a program to design, construct, calibrate and field test an Ozone-specific instrument using a chemiluminescent principle. The document is also an instruction manual, with two separate attachments included; a set of engineering drawings for the machine shop fabricated parts and a subsystem manual comprised of instruction sheets and manuals for the individual commercially procurred units. Author (GRA)

N71-29778*# National Aeronautics and Space Administration, Washington, D.C.

THERMAL SENSING OF THE ATMOSPHERE FROM SATELLITES

K. Ya. Kondratyev et al Jun. 1971 374 p refs Transl. into ENGLISH of the publ. 'Termicheskoye Zondirovaniye Atmosfery so Sputnikov' Leningrad, Gidromet., 1970 p 1 - 408
(NASA-TT-F-626) Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

The results of Soviet and foreign experimental, theoretical, and instrumentation developments are summarized with a bearing on the utilization of the outgoing thermal radiation to study the earth's atmosphere. The angular and spectral distributions of the outgoing radiation and problems in determining the temperatures of the underlying surface and the upper cloud boundary, stratosphere temperatures, and troposphere moisture are analyzed in detail. Data related to theoretical and experimental aspects of atmospheric thermal sensing and determination of vertical moisture profiles from satellites are presented. The possibilities of a complex approach to a solution of the set of inverse problems and the prospects for further research are briefly discussed. Author

N71-29792# Technische Univ., Berlin (West Germany). Fakultaet fuer Elektrotechnik.

PHOTOMETRIC MEASUREMENTS WITH HIGH FREQUENCY MODULATED FLASHLIGHT SCAN OF FAST PHOTOCHEMICAL REACTIONS [PHOTOMETRISCHE MESSUNGEN SCHNELLER PHOTOCHEMISCHER REAKTIONEN MIT HOCHFREQUENT MODULIERTEM MESSLICH]

Horst-Eberhard Buchwald (Ph.D. Thesis) 1969 71 p refs In GERMAN
Avail: NTIS

The development of a photometer with high frequency modulated flash scan is described. The apparatus measures rapid developing primary processes during photosynthesis at wavelengths where a strong chlorophyl fluorescence develops. Measurements of the fading kinetic in the chlorophyll-a sub II-light reaction are obtained and a half line time is determined; rapid absorption changes of the type 1 are also measured and it is shown that these changes are not attributable to the chlorophyll and that the Ch1-a sub II-center does not represent an intermediate step in the electron transport chain. Transl. by G.G.

N71-29900 National Lending Library for Science and Technology, Boston Spa (England).

SYSTEMATIC STUDY OF THERMOCOUPLES IN TEMPERATURE MEASUREMENTS: CHROMEL-ALUMEL THERMOCOUPLES

M. Campari et al [1971] 15 p refs Transl. into ENGLISH from Italian report CESNEF-IN-002 (.. 1969
(NLL-Risley-Trans-1942-(9091.9F); CESNEF-IN-002) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupon

Although the interest is centered on chromel-alumel thermocouples, the theoretical basis of the problem is of quite general validity. After a short analysis of the thermodynamic basis of the thermoelectric effect, a representation is constructed which is adequate to establish a connection between the results of the measurements on the one hand and the equations of the mathematical formalism on the other hand. The problem is then presented of the physical definition and hence of the measurement of the thermoelectric power in the thermocouples when these are not spatially homogeneous. Finally chromel-alumel thermocouples are considered, and an attempt is made to combine into a coherent physical interpretation the hints offered by various experimental workers concerning the mechanisms of the changes (in the absence of radiation fields) in the thermoelectric power and electrical conductivity. Author

N71-29819*# Scientific Translation Service, Santa Barbara, Calif.
FUTURE PROSPECTS FOR THE USE OF TELEVISION MICROSCOPY TO DETECT EXTRATERRESTRIAL LIFE [PERSPEKTIVY PRIMENENIYA TELEVISIONNOY MIKROSKOPII DLYA OBNARU ZHENIYA VNEZEMNYKH FORM ZHIZNI]
B. L. Kozlov Washington NASA Jul. 1971 8 p refs Transl. into ENGLISH from Russian report PR-12, 1969 11 p
(Contract NASw-2035)
(NASA-TT-F-13733) Avail: NTIS CSCL 14B

The most important factors responsible for the initiation and wide development of television microscopy as an independent trend in scientific research in both Earth and space laboratories are considered. Since television microscopy is one of the most informative techniques for studying microstructures, one of the immediate tasks is the complete automation of all systems. Material is presented which demonstrates the necessity for using special systems of automatic focusing of microimages. Author

N71-29888 Oregon State Univ., Corvallis.
THE THEORY AND APPLICATION OF GALVANOVOLTAMETRY. DESIGN, CONSTRUCTION AND EVALUATION OF A CONTINUOUS LIQUID STREAM ANALYZER EMPLOYING A GALVANOVOLTAMMETRIC DETECTOR AND LOW COST AUTOMATIC DIGITAL CONCENTRATION READOUT
Donald Ray Kendall (Ph.D. Thesis) 1970 216 p
Avail: Univ. Microfilms Order No. 70-14136

The theory and ways of applying a new electroanalytical detection method were developed. The method, called galvanovoltammetry, consists of the measurement of current from the bipolar electrode of a three electrode cell which consists of a working electrode and a counter electrode, between which a constant current is applied, and a bipolar electrode which forms a galvanic cell with the working electrode. An equivalent model circuit for a galvanovoltammetry cell was proposed and used in discussions pertaining to the theory of cell operation. The effects which various cell and sample parameters have on the operation of a galvanovoltammetry cell were investigated and the results utilized to discuss how parameter values are chosen for any particular application. Dissert. Abstr.

N71-29910*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EARTH PHOTOGRAPHY FROM HIGH-ALTITUDE BALLOONS
Dona L. Cauchon, Leonard P. Kopia, and Leon A. Williams, Jr. Washington Jul. 1971 35 p refs
(NASA-TM-X-2208; L-7436) Avail: NTIS CSCL 14E

Large-area photographs of the earth were obtained from high-altitude balloon platforms. Some of the photography was coordinated with ground investigations for experimental purposes. The usefulness of large-area photographs and unique photographic formats is evaluated. Certain advantages and disadvantages of free-flight balloons as remote sensing platforms are discussed. Two appendixes detail the camera system and camera-package design. Author

N71-29917# National Oceanographic Instrumentation Center, Washington, D.C.
INSTRUMENT FACT SHEET: MODEL 776-21 CONDUCTIVITY-TEMPERATURE-DEPTH UNDERWATER SENSOR UNIT, GEODYNE DIVISION, EG AND G INTERNATIONAL
May 1971 8 p
(IFS-71012) Avail: NTIS; Natl. Oceanographic Instrumentation Center

The Geodyne model 776-21 CTD underwater sensor unit is designed to measure the ocean parameters of conductivity in the range between 25 and 65 millimhos, temperature in the range between −2 C and +35 C, and pressure to 500 psia. The sensor unit is interrogated remotely by deck equipment consisting of a model 993 digital display monitor, a model 990 cable interface unit, and a model 256-0 power supply. Only the underwater sensor unit is considered in the evaluation reported in this Fact Sheet. Author

N71-30028* Fairchild Hiller Corp., Germantown, Md.
SPACE SIMULATION AND RADIATIVE PROPERTY TESTING SYSTEM AND METHOD Patent
Frank Edward Badin and Franklin Dennis Farnsworth, inventors (to NASA) Issued 13 Aug. 1968 6 p Filed 26 Feb. 1965 Cl. 73-432 Sponsored by NASA
(NASA-Case-MFS-20096; US-Patent-3,396,584; US-Patent-Appl-SN-435433) Avail: US Patent Office CSCL 14B

A method and necessary apparatus for testing the heat radiative properties of material under controlled environmental conditions is described. The temperature of the specimen is measured in response to irradiation by energy of a second type. It is then irradiated by the energy of the first type and the temperature response is measured. The environment is maintained at constant conditions and the specimen is not handled or exposed to the atmosphere. Official Gazette of the U.S. Patent Office

N71-30120# Stockholm Univ., (Sweden). Inst. of Physics.
CONSTRUCTION AND EXAMINATION OF A GAS SCINTILLATION DETECTOR
Bjoren Englund Mar. 1970 38 p refs In SWEDISH; ENGLISH summary
(USIP-70-1) Avail: AEC Depository Libraries

A xenon gas scintillation detector, with an active volume of 12 × 12 × 25 cu cm, was constructed. The performance of the detector related to purity of xenon gas and optical components, such as reflectors, wavelength shifters, and lightguides, was investigated using alpha-particles and cosmic ray muons. The best results were obtained with p-terphenyl and phenylene bis-5-phenyl oxazole as wavelength shifter and when the photomultiplier was directly attached to the quartz window of the detector. Using 5 MeV alpha particles, the detected peak had a width of 7%. The spectrum obtained from cosmic ray muons was in agreement with the calculated distribution. The possibilities of using such a detector to discriminate between highly relativistic particles is discussed. Author (NSA)

N71-30158# California Univ., Berkeley. Lawrence Radiation Lab.
DEVELOPMENT OF NEUTRON LEAKAGE SPECTROMETERS WITH EMPHASIS ON THE KeV RANGE

Rudolph J. Henninger (Ph.D. Thesis) Mar. 1971 106 p refs
(Contract W-7405-eng-48)
(UCRL-20148) Avail: NTIS

Calculations were performed to design and analyze a set of neutron spectrometers consisting of cadmium-covered, spherically-shaped, resonance-absorbing cores, surrounded by varisized polyethylene spheres. Some of the detectors had an additional layer of boron around the polyethylene. Because of the combined effects of leakage and moderation in the polyethylene, the measured activation of the resonance absorber depends on the incident neutron energy, with a maximum in an energy range determined by the sizes and properties of all the materials. This response is proportional to the adjoint flux, which is calculated by the multigroup discrete ordinate transport code ANISN. The adjoint boundary condition is the probability that a neutron entering the core is captured there. It is assumed that this probability is independent of the presence of the surrounding materials. Calculations were performed for polyethylene sphere diameters varying from 2 to 10 in. to find a set useful in the keV region.
Author (NSA)

N71-30285* Ford Motor Co., Dearborn, Mich.
OMNIDIRECTIONAL ACCELERATION DEVICE Patent
Wilbur W. Hawley, David H. Geipel, and Willis D. Longyear, inventors (to NASA) Issued 6 Sep. 1966 4 p Filed 26 Dec. 1962 Cl. 73-497 Sponsored by NASA
(NASA-Case-HQN-10780; US-Patent-3,270,565; US-Patent-Appl-SN-247136) Avail: US Patent Office CSCL 14B

A liquid filled omnidirectional accelerometer is described for measuring acceleration forces independent of direction. The static pressure of the liquid in a spherical chamber at the center of the spherical housing is measured providing an output directly proportional to the acceleration forces from any direction. Means are provided for compensating for housing and liquid temperature changes.
J.M.

N71-30284# Naval Research Lab., Washington, D.C.
INVESTIGATION OF THE IMAGING CHARACTERISTICS OF A KINOPTIC 9.8-mm LENS Final Report
Frank A. Daspit 25 Mar. 1971 14 p
(AD-722335; NRL-7245) Avail: NTIS CSCL 14/5

In the process of evaluating the overall performance of the wide-angle camera system used aboard the USNS Mizar (TAGOR-11) for underwater search, it was decided to investigate the imaging characteristics of the Kinoptic 9.8-mm lens used with the camera in order to isolate its limitations from those of the other components of the system. In use the lens is mounted behind a watertight, hemispherical glass dome. The water/glass, glass/air interfaces formed by the dome act as a negative lens, forming a virtual curved image of the (relatively) flat ocean bottom. This image in turn serves as the object for the camera lens. Tests were made of the lens ability to image both flat and curved objects in air, extending across its field of view. The tests show that the resolving power of the lens falls off greatly at the edge of the field of view for curved objects, so much so that only the general form of the resolution target can be distinguished. For both flat and curved objects, radial resolution is nearly twice as good as tangential resolution.
Author (GRA)

N71-30386 National Lending Library for Science and Technology, Boston Spa (England).
MOISTURE PROTECTION OF STRAIN GAUGES
G. Andreae 10 Sep. 1970 12 p refs Transl. into ENGLISH from Proceedings of Conf. on Stress Analysis (Cambridge), 6–10 Apr. 1970
(NLL-CE-Trans-5404-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The technology of applying a protective coating to strain gages is discussed. Film thickness, permeability coefficients, application techniques, duration of protection, and practical experience are described.
N.E.N.

N71-30389# Council for Scientific and Industrial Research, Pretoria (South Africa).
DETERMINATION OF FLUID VELOCITY AND DIRECTION IN OPEN TANKS WITH A PROBE USING RADIOACTIVE PULSES
K. J. Scott and J. P. Paulsen Apr. 1970 9 p
(CSIR-SR-CHEM-133) Avail: AEC Depository Libraries

Radioactive pulses are emitted radially inward from a ring (d = 18 cm) and radioactivity measured by two detectors placed just off-perpendicular 15 cm from the center of the ring. This probe operates satisfactorily in the range 5 to 30 mm/sec and is capable of determining flow direction within 5 deg.
Author (NSA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-29214*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PRELIMINARY EVALUATION OF THE CORING POTENTIAL OF THE APOLLO LUNAR SURFACE DRILL TITANIUM CORE STEM
John F. Lindsay and Richard Perry (Lamont-Doherty Geological Obs.) May 1971 11 p
(NASA-TM-X-58057) Avail: NTIS CSCL 13I

Drilling tests to evaluate the coring potential of the Apollo lunar surface drill titanium core stems were conducted. It was found that core recovery is dependent on drilling rates. Core sample covpaction and losses during extraction and capping of the stems are discussed. From the viewpoint that cohesion is an important property of lunar soil when coring with the drill, the soil model from the Manned Spacecraft Center was concluded to be more representative of lunar soil than the one from Denver and should be used until more information about lunar soil is available.
Author

N71-29263# California Univ., Livermore. Lawrence Radiation Lab.
BURNISHING METAL TO FINE FINISHES WITH A ROLLING BALL
C. M. Gordon and G. W. Roust 9 Nov. 1970 11 p ref Sponsored by AEC
(UCRL-50864) Avail: NTIS

The surface finish on machines metal parts can be improved or modified by rolling a ball under pressure over the finish to iron surface imperfections. The action of the ball improves the numerical finish designation of the surface, compacts surface elements, modifies stresses in the surface, work hardens the surface of some metals, and increases surface reflectivity.
Author

N71-29365# Technische Hogeschool, Delft (Netherlands).
THE FUNDAMENTALS OF THREE DIMENSIONAL CHIP CURL, CHIP BREAKING AND CHIP CONTROL
Cornelis Spaans (Ph.D. Thesis) 24 Mar. 1971 218 p refs
Avail: NTIS

The chip formation process and the means of controlling the chip were investigated. Five models were developed and tested. One model concerned an application to metal cutting of recent results on stress-strain, rate-temperature behavior of iron.

With a second model it was possible to predict the chip flow angle in cutting with a tool nose, the curl of the chip resulting from external forces exerted on the chip, the chip flow angle in oblique cutting, the chip to tool contact length by means of cutting forces and cutting ratio, and the parasitic forces acting on the tool. The third model concerns the assessment of the shape of a chip from three components: upward curling, sideward curling, and chip flow angle. The fourth model concerns a computer simulation of the formation of ear chips. The fifth model concerns a phi angle relationship based on the principle of minimum dissipation in which the interrelationship between the shear zone and the builtup layer, and the stress-strain, rate-temperature properties of the material are taken into account. Also, a new method of measuring the chip to tool contact length during cutting is presented. Author

N71-29388# Rolls-Royce, Ltd., Leavesden (England). Small Engines Div.

EVALUATION OF THE REQUIREMENTS FOR THE APPROVAL OF WELD THROUGH PRIMERS

H. C. Inward London Min. of Trade and Ind. 1971 35 p

London Min. of Trade and Ind. 1971 35 p

(Contract KS/1/0531/C.B.43(a)2)

(D-MAT-170) Avail: NTIS

In order to consider a specification for weld through primers, certain parameters were investigated. The effects of different surface treatments and different types of primers on the surface resistance were determined. Welding consistency tests, as evaluated by shear strength, X-ray and metallographic examinations, were carried out. A corrosion test was developed and used to evaluate the effect of weld through primers in minimizing corrosion. The overall assessment was that when using some weld through primers, satisfactory weld quality could be maintained. However, these primers, although reducing the tendency for corrosion, were not completely effective as corrosion inhibitors. Author (ESRO)

N71-29468*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

HIGH TEMPERATURE FASTENER TECHNOLOGY

Frank D. Boensch, William H. Goesch, and Allan M. Morton (Martin Marietta Corp.) *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 585-599 ref (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 13E

Research results indicate that: (1) Reusable fastener technology is ready for engineering development at temperatures up to 2600 F. Superalloy and coated columbium fasteners have been developed and ground tested. Dry film lubricant development appears needed to prevent extensive galling and seizure of superalloy fasteners. (2) Integration of the total fastener system is required; that is, compatibility of the fastener material, coating system, and structure to be fastened must be insured. (3) The total fastener environment must be evaluated before a commitment can be made. It is not enough to select a fastener based on any one property or characteristic; the fastener must be evaluated over the entire use spectrum before a given material or even a fastener configuration is selected. Author

N71-29469*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BEARINGS, LUBRICANTS, AND SEALS FOR ACTUATORS AND MECHANISMS

Robert L. Johnson, William R. Loomis, and Lawrence P. Ludwig *In its* NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 601-632 refs (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 13I

Lubricated and hydraulic components for the shuttle vehicle with high temperature and vacuum operating capabilities were investigated. A review of C-ethers as potential hydraulic fluids and lubricants indicates important advantages of increased thermal stability, high bulk modulus, high surface tension, and low vapor pressure. Good progress is reported in resolving lubricant-coolant deficiencies of the base fluid by formulation. Actuator rod seals with polyimide chevron sealing elements and molecular flow impedance are described. Problems of rotating shaft seals are discussed and the design concept is presented of spiral groove for liquids and helical groove molecular flow pumping seals for low density vapor. Vibration as well as high temperature is suggested as an airframe bearing problem. Calcium-fluoride lubricated porous metal composites and mechanical carbons are indicated to have the advantage of good damping capacity in addition to useful friction behavior. Author

N71-29495# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SMOOTH ROLLING OF PARTS BY ROLLERS AS A MEANS OF INCREASING THE WEAR RESISTANCE

V. M. Braslavskii et al 18 Jan. 1971 17 p refs Transl. into ENGLISH from Sb. Statey Proizv. Krupnykh Mashin (Moscow), no. 19, 1969 p 136-144

(AD-722289; FTD-MT-24-281-70) Avail: NTIS CSCL 13/9

A survey of works is provided, concerning the effect of cold plastic deformation of machine parts to increase wear resistance under various conditions of friction. In the majority of the published works, the principal attention is devoted to the wear of the rolled surfaces themselves. Meanwhile the service life of a friction couple is determined by the total wear of the two coupled parts. An investigation is cited of a friction couple consisting of a steel shaft and a bronze insert, in application to the operating conditions of components of conical crushers. The tests were carried out on a friction machine. The specimens were made of steel 40 and were burnished with various degrees of force. The insert was made of the bronze BR.OTsS 8-21. Comparative tests have shown that the wearing in of burnished specimens takes place several times more rapidly than that of ground ones, and their wear in that period is 3-3.5 times less. The wear of bronze inserts working with burnished shafts is considerably less than the wear of inserts operating with ground shafts. As a result of burnishing of the shafts, the wear-in time of friction couples may be reduced by a factor of more than 20. GRA

N71-29722 National Lending Library for Science and Technology, Boston Spa (England).

THE EVALUATION OF RADIOGRAPHICALLY DETECTED WELD DEFECTS IN STEELS WITH THEORETICAL CONSIDERATION OF THE SUSCEPTIBILITY OF WELD METAL TO BRITTLE FRACTURE

T. Konkoly 1970 12 p refs Transl. into ENGLISH from the Proceedings of 6th Intern. Conf. on Non-Destructive Testing (Hanover), 1 5 Jun. 1970

(NLL-CE-Trans-5486(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The significance of the mechanical properties and the susceptibility of weld metal to brittle fracture was considered in assessing the effect of weld defects on the ability of welded seams to withstand mechanical or other stresses, and to determine limits which can be tolerated by components under the most diverse operational conditions. The tendency to brittle fracture was measured at subzero temperatures on tensile specimens notched to give various form factors and was determined for various weld metals by measuring the specific fracture energy. Using this physically correct experimental value, the stress-concentrating effect of the defects could be related to the notch sensivity of the weld metal. Author

N71-29806# Southern Research Inst., Birmingham, Ala.

AN ELECTROSTATIC PRECIPITATOR SYSTEMS STUDY Final Report, 16 Apr. 1969 - 30 Sep. 1970

30 Oct. 1970 70 p

(Contract CPA-22-69-73)

(PB-198150; A-378-2291-19) Avail: NTIS CSCL 13I

The status is reviewed of precipitator technology and the application of electrostatic precipitators in industrial dust control. The industries mentioned include: Cement, pulp and paper, magnesia, phosphorus, lime, gypsum, sulfuric acid, petroleum, iron and steel, electric power generation, nonferrous metals, and incinerators. Author (GRA)

N71-29806# Society of Automotive Engineers, Inc., New York.
AN ENERGY ABSORBING RESTRAINT SYSTEM
Richard W. McLay (Vermont Univ.), Fred J. Blackstone, and P. K. Das (Yale Univ.) 15 Apr. 1970 19 p refs Presented at the Automotive Eng. Congr., Detroit, 11–15 Jan. 1971
(PB-197843; SAE-7100078) Avail: NTIS CSCL 13F

An energy-absorbing restraint system that limits the accelerations of a passenger in a forward auto crash to 20 g's is presented. The device absorbs energy through the continuous bending of a steel wire. Results of an elastic-plastic analysis of the device indicate that it closely approximates a constant force energy absorber; the force is only a weak function of velocity. Preliminary results from drop tests and high-speed impact tests to 100 mph indicate that the absorber can limit acceleration to a specified value. The results of two tests in which the device was used to restrain a volunteer during a head-on crash are presented. In each crash a vehicle driven at 50 mph impacted a parked vehicle. The results show that the restraint system protects a man in a forward crash by limiting his accelerations to a level below the threshold of injury for the vital organs. Author (GRA)

N71-29813# Army Edgewood Arsenal, Md.
VACUUM-BRAZING: GAS QUENCHING HISTORY, DEVELOPMENT, AND OVERALL PROGRAM
Francis B. Gurtner, Paul K. Shutt, Jr., Charles F. Burrows, W. J. Werner, and James L. McCall Jan. 1971 259 p refs
(AD-722730; EA-TR-4482) Avail: NTIS CSCL 13/8

The vacuum-brazing and vacuum-heat-treat, gas-quenching process is a reliable process for fabricating hardware items where helium leak-tight joints are required. New filler metals were developed for vacuum-brazing aluminum alloys, and metallographic examination was accomplished on all metals. Author (GRA)

N71-29825 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF THE CHARACTERISTICS OF THE SPRINGS UPON THE ACTION OF THE DISC VALVES AND ON THE ECONOMIC INDICES OF THE COMPRESSOR [WPLYW CHARAKTERYSTYKI SPREZYN NA DZIALANIE ZAWOROW PLYTKOWYCH I NA WSKAZNIKI EKONOMICZNE SPREZARKI]
S. Steindel Oct. 1970 60 p refs Transl. into ENGLISH from Arch. Budowy Maszyn (Poland), v. 11, no. 2, 1964 p 311–343
(NLL-RTS-5938) Avail: Natl. Lending Library, Boston Spa, Engl.: £5.00; 17 NLL photocopy coupons

The object of the investigation was to find to what degree and how the characteristics of the disc valve springs influence the action of the valves and the functioning of the compressor, and also to ascertain the extent to which the parameters of the springs, in the calculations based on the formula adduced from reference works or publications, approach the optimal conditions. Certain assumptions were adopted for simplification of the calculations, although these may affect somewhat the accuracy with which the spring parameters are determined. Author

N71-29877# Hanford Environmental Health Foundation, Richland, Wash.
RETESTING SELECTED USED HEPA FILTERS TO DETERMINE OPTIMUM FILTER LIFE UNDER VARIOUS OPERATING CONDITIONS Progress Report
L. L. Sims *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 824–831 (See N71-29851 17-13)
Avail: NTIS HC $6.00/MF $0.95

A program is described which is being undertaken by the Hanford Environmental Health Foundation to gather performance data on HEPA filters at the termination of their use in AEC facilities and to compare these data with the performance of the same filters, tested under nearly identical conditions, prior to their use. No comparative data on filter performance before and after use are given. NSA

N71-29879*# National Aeronautics and Space Administration, Washington, D.C.
NASA EXPERIENCE (POLICY) WITH HEPA FILTERS
D. J. Keigher *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 837–838 (See N71-29851 17-13)
(NASA-TM-X-67249) Avail: NTIS CSCL 13K

The uses of High Efficiency Particulate Aerosol (HEPA) filters at various NASA installations, and two NASA specifications for the installation and testing of HEPA filters are briefly discussed. NSA

N71-29905# Cornell Univ., Ithaca, N.Y. Graduate School of Aerospace Engineering.
FERROHYDRODYNAMIC PROPULSION Annual Report
E. L. Resler, Jr. Mar. 1971 20 p refs
(Contract N00014-67-A-0077-0011)
(AD-722356) Avail: NTIS CSCL 11/7

The possibility of using a ferromagnetic fluid to generate pressure forces for propulsion of sea vehicles is examined. Estimates are made for the magnetic field strengths required. Preliminary experiments are briefly described and some proposed changes in accepted theory. The feasibility of such propulsion is established theoretically. Author (GRA)

N71-30024# Technische Hochschule, Darmstadt (West Germany).
ON THE TEMPERATURE RANGE AND APPLICATION LIMITATIONS OF DRY OPERATING GRAPHITE RING SEALS [UEBER DEN TEMPERATURVELAUF UND DIE EINSATZGRENZEN VON TROCKENLAUFENDEN GRAPHIT-DICHTRINGEN]
Horst Hartmann (Ph.D. Thesis) 1970 124 p refs In GERMAN
Avail: NTIS

Theoretical and experimental studies reported determine the developing heat flux in gliding friction ring seals during operation and establish a limitation for friction caused crack formation on the sealing surface. Macroscopic cracks in the graphite ring are attributed to the developing radial heat flux during high friction loads. Transl. by G.G.

N71-30028* Crane Co., Burbank, Calif. Hydro-Aire Div.
HYDRAULIC TRANSFORMER Patent
Jorge A. Morando, inventor (to NASA) Issued 26 Jul. 1966 10 p Filed 10 Jun. 1963 Cl. 103-49 Sponsored by NASA
(NASA-Case-MFS-20830; US-Patent-3,262,395; US-Patent-Appl-SN-286620) Avail: US Patent Office CSCL 13I

A variable displacement fluid pumping apparatus for spacecraft application is described. The device provides a fluid pressure transformer which uses hydraulic fluid under pressure at one level to drive a series of free pistons in a positive displacement pump which delivers hydraulic fluid at a different pressure level to a load. Official Gazette of the U.S. Patent Office

N71-30042# European Space Research Organization, Paris (France).
SCREENING OF SPACE MATERIALS WITH THE MICRO-VCM WEIGHT-LOSS TEST
A. Zwaal (ESRTC), J. Dauphin (ESRTC), and A. Alonzo Roldan (INTA) Feb. 1971 43 p refs

(ESRO-TN-110-ESTEC) Avail: NTIS

The results obtained during one year of operation of the micro-VCM (volatile condensible material) weight-loss test as a screening method for materials to be used in ESRO satellites are reported. The VCM test is based on a an accelerated vacuum exposure of small samples of materials (approximately 200 mg) under a pressure of 0.000001 torr, and a temperature of 125 C for 24 hours. The weight-loss of the sample is assessed by weighing before and after exposure. A condenser plate maintained at 25 C and placed in front of the sample during the exposure permits the assessment of the condensible contaminants evolved by a material. The equipment enables 24 samples to be screened at a time, the acceptance limits being total weight-loss less than or equal to 1% and condensible contaminants less than or equal to 0.1%. Some of the results obtained in the screening of materials to be used in the satellites HEOS A2, TD and ESRO 4 are presented, as are results obtained in a preliminary assessment of some European commercial materials for inclusion in a future ESRO Space Qualified Materials list. Author (ESRO)

N71-30075# Technische-Hochschule, Darmstadt (West Germany).

FUNDAMENTALS OF SYNTHETIC MATERIALS PROCESSING [GRUNDLAGEN DER KUNSTSTOFFVERARBEITUNG]

W. Knappe (Ph.D. Thesis) 1970 225 p refs

Avail: NTIS

The basic technical processing methods for synthetic materials are summarized from raw materials to the finished product order to an intermediate product for further treatment. Considered are material preparation, forming at high pressures and temperatures, forming at low pressures and temperatures, shaping, mixing, separating, refining, and purification methods. Transl. by G.G.

N71-30121*# Aerojet-General Corp., Azusa, Calif.

NaK-LUBRICATED JOURNAL AND THRUST BEARINGS FOR A PUMP MOTOR ASSEMBLY IN SNAP-8

J. R. Pope Jun. 1971 48 p refs

(Contract NAS5-417)

(NASA-CR-72824) Avail: NTIS CSCL 13I

The operational experience with SNAP-8 pump-motor assembly bearings lubricated with high temperature sodium-potassium alloy (NaK-78) is presented. The bearings were segmented, hydrodynamic fluid film, tilting pad journal bearings and Kingsbury-type self-aligning thrust bearings. The experience included development tests and separate endurance tests of 3,000 and 10,000 hours utilizing a complete pump-motor assembly. Minor development problems were encountered, but the bearings completed the endurance tests satisfactorily with no measurable bearing wear. Inspection revealed minor scratches to the journal bearings which were attributed to oxides passing through the bearings or other contaminants in the NaK lubricant. Author

N71-30152*# Fairchild Stratos Corp., Manhattan Beach, Calif.

RELIEF VALVE ASSEMBLY, STRATOS PN 834000 Final Report

J. Morando 20 May 1971 170 p refs

(Contract NAS8-26358)

(NASA-CR-119177; ER-834-7) Avail: NTIS CSCL 13K

The results of a program to develop, manufacture, and qualify a relief valve assembly intended for use in the metabolic activity system of the biological experiments to be conducted in the orbital workshop vehicle are reported. The relief valve assembly development program described in this document achieved all of the established requirements; and in addition demonstrated that the valve, based on design used in this program, is capable of meeting even more stringent performance requirements for internal leakage and pressure band (reseat to full flow). Author

N71-30160# Martin Marietta Corp., Denver, Colo.

CENTER FOR HIGH ENERGY FORMING . Quarterly Report, 1 Jan. - 31 Mar. 1971

Jimmy D. Mote 1 Apr. 1971 32 p ref Prepared jointly with Denver Univ.

(Contract DA-19-066-AMC-266(X); ARPA Order 720)

(AD-722694; AMRA-CR-66-05/28) Avail: NTIS CSCL 13/8

The report summarizes results during the period 1 January through 31 March 1971: Die stress program; Applications of explosive welding to hardware configurations; Flange buckling of explosively formed domes; Explosive forming with vented dies; Optimization of the explosive forming of tank ends; Prediction of edge pull-in explosively formed domes; Fracture toughness of explosively formed high strength steel; Explosive powder compaction; Theoretical studies of explosive energy transfer to a thick walled cylinder using a radial piston; Explosive thermomechanical processing; and The mechanics of the reloading phenomenon in explosive forming of domes. Author (GRA)

N71-30239*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

APPLICATION OF CAPACITOR MICROPHONES AND MAGNETIC PICKUPS TO THE TUNING AND TROUBLE SHOOTING OF MICROELECTRONIC ULTRASONIC BONDING EQUIPMENT

George G. Harman and Herbert K. Kessler May 1971 29 p refs Sponsored in part by NASA, DASA, and Navy

(NASA-CR-119066; NBS-TN-573) Avail: SOD $0.35; NTIS CSCL 13E

Microelectronic ultrasonic wire bonding equipment typically welds wires to integrated circuits at frequencies between 50 and 65 kHz. Mechanical vibrations at these frequencies are difficult to measure directly and malfunctions of the system may not be recognized. Two different methods of measuring these vibrations are described. The first method involves use of a capacitor microphone and a tapered tip, and the second method use of a small magnetic pickup. Procedures are given for establishing a specific ultrasonic vibration amplitude, tuning the ultrasonic system to resonance, and diagnosing both mechanical and electrical problems in wire bonding equipment. Author

N71-30246# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THIN WALL CHANNEL TEST ON A LIQUID ALUMINUM INDUCTION PUMP

M. M. Saar et al 22 Jan. 1971 14 p ref Transl. into ENGLISH from Tr. Politekhn. Inst. (Tallinn), no. 124, 1964 p 123 130

(AD-722310; FTD-HC-23-669-70) Avail: NTIS CSCL 13/11

The article gives the results of a laboratory test of a thin-wall channel with a ceramic lining in an induction pump for pumping liquid aluminum, and gives a description of the experimental apparatus. The walls of the thin-wall channel were made of heat resisting steel with a thickness of 1 mm. To protect the thin-wall channel from the corrosive action of liquid aluminum, its inner surface was covered with a ceramic coating 100 microns thick. The basic components of the lining were high melting oxides and carbides. The results of the experiment confirmed the possibility of using a thin-wall channel in an induction pump for pumping liquid aluminum. Use of a thin-wall channel with a ceramic lining increases the power characteristics of an induction pump. Author (GRA)

N71-30365 National Lending Library for Science and Technology, Boston Spa (England).

SOME ASPECTS OF WELDING APPLIED TO HEAVY FABRICATIONS

C. Forcinal 8 Oct. 1970 36 p refs Transl. into ENGLISH from Soudage Tech. Connexes (France), v. 22, no. 5-6, May-Jun.

1968 p 217–238
(NLL-CE-Trans-5294-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Welded mechanical constructions and welded pressure parts are discussed, particularly from the view of making large thermal and hydroelectric power stations. Assembly, welding technology, and stress relieving heat treatment are considered for the welded mechanical construction. In welded pressure part fabrication, attention is given to forming, longitudinal joints, circular joints, and attachments. Inspection techniques before, during, and after welding are outlined, and the need for better and more uniform quality controls is indicated. N.E.N.

N71-30390# Tokyo Univ. (Japan). Inst. for Nuclear Study.
ELECTROPLATING OF PROTON LINEAR ACCELERATOR TANKS
J. Tanaka, T. Nishikawa, H. Baba, and S. Okumura Apr. 1970 11 p ref
(SJC-A-70-3) Avail: AEC Depository Libraries

A method for electroplating copper on the accelerator tanks of a proton linac is described. Topics include copper-plating by ordinary acid copper bath, acid copper bath with brightening agent, copper deposition on the inner surface of steel cylinder, the influence of holes, plating on flanges with contacter grooves, Q value of copper plated test cavity, and a 1-meter long model accelerator tank. NSA

N71-30397*# Aerojet Liquid Rocket Co., Sacramento, Calif.
APOLLO SERVICE PROPULSION SYSTEM ROCKET ENGINE BIPROPELLANT VALVE IMPROVEMENT PROGRAM Final Report
Feb. 1971 95 p
(Contract NAS9-8317)
(NASA-CR-108577) Avail: NTIS CSCL 13K

A summary and technical discussion are presented of a program for the design and fabrication of an optimized service propulsion system valve concept. Previous experience and tradeoff studies are reviewed and an outline of the program tasks is given. Information on both the hypergolic and cryogenic propellant portions of the program is reported with emphasis placed on the cryogenic portion. Conclusions and recommendations resulting from the study are detailed. D.L.G.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-29225*# Translation Consultants, Ltd., Arlington, Va.
ATOMIC ABSORPTION SPECTRA IN A VAPOR CLOUD FORMED BY LASER IRRADIATION [NEKOTORYYE ISSLEDOVANIYA SPEKTROV ATOMNOY ABSORBTSII V OBLAKE PAROV, OBRAZOVANNOM IZLUCHENIYEM OPTICHESKOGO KVANTOVOGO GENERATORA]
Ye. A. Afanasyev Washington NASA Jun. 1971 8 p refs Transl. into ENGLISH from the Publ. 'Spektroskopiya Atomov i Molekulov' Kiev, Naukova Dumka, 1969 p 46–50
(Contract NASw-2038)
(NASA-TT-F-13688) Avail: NTIS CSCL 20E

The apparatus consisted of a Nd glass laser with an output of sufficient capacity to volatilize 1 mg of the Cr steel sample. Accessories were the usual split beam to provide monitoring and a trigger pulse, a centering prism, and a focusing lens, and, in the absorption spectral output, a splitter feeding to a focusing lens and a plate camera, and to a nonfocused camera to monitor the plasma intensity and speed of development. Spacing of the laser beam from prism to target is critical. Proper positioning of the target gives the most rapid plasma cloud development, usually approximately 100 microseconds/cm; synchronization < or = 50 microseconds with the illumination gave best reproducibility and accuracy. Author

N71-29315# Royal Aircraft Establishment, Famborough (England).
A BIBLIOGRAPHY ON OPTICAL MODULATORS
B. Ellis and A. K. Walton (Sheffield Univ.) Jan. 1971 32 p refs Sponsored partly by ESRO
(RAE-TR-71009) Copyright. Avail: NTIS

Approximately 250 references, many of which carry brief annotation, are provided, covering the field of optical modulation over the span 1950–1970. Author (ESRO)

N71-29748# Avco-Everett Research Lab., Everett, Mass.
FEASIBILITY STUDY OF REMOTE MONITORING OF GAS POLLUTANT EMISSIONS BY RAMAN SPECTROSCOPY
Donald A. Leonard Dec. 1970 55 p refs
(Contract CPA-22-69-62)
(PB-198204; AERL-RR-362; APTD-0658) Avail: NTIS CSCL 13B

The cross sections were measured using a 3371-A pulsed nitrogen laser as the Raman exciting source. Using N2 as a normalizing standard, the results are best fit by a NO to N2 Raman cross-section ratio of 0.5 + 0.1 and a SO2 to N2 Raman cross-section ratio of 2.4 plus or minus 0.3. Raman spectra of N2, O2, H2O and CO2 were obtained from a power plant stack plume at a slant range of 625 feet without interference and detailed field procedures were developed which permit quantitative profiles of the concentration of these molecules in the plume to be routinely obtained. However, NO and SO2 were not observed in the field study, due primarily to the insufficient stray light rejection ratio of the monchrometer used in the system. Author (GRA)

N71-29911# Research Inst. of National Defence, Stockholm (Sweden).
THERMONUCLEAR REACTIONS THROUGH LASER RADIATION OF FUSION MATERIALS
Erik Witalis Jan. 1971 20 p refs In SWEDISH
(FOA-4-4449) Avail: AEC Depository Libraries

The use of lasers for fusion weapons as well as for hydrogen energy is discussed. Criteria for an exothermic laser-induced fusion process are formulated. An account of known calculations and estimations show that the existing laser systems are several magnitudes too small for direct use in fusion weapons or for peaceful use of hydrogen energy. However, it is shown that in combination with well established methods, generation and heating of a plasma with laser radiation would be feasible. Finally, the fields within laser and plasma physics in which important developments of laser-induced fusion processes can be expected are given. NSA

N71-30012*# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
THE PROPAGATION OF COHERENT RADIATION IN A CYLINDRICAL PLASMA COLUMN
Loren C. Steinhauer and Harlow G. Ahlstrom Washington NASA Jul. 1971 13 p refs Sponsored in part by NSF
(Grants NGL-48-002-044; NSF GK-2694)
(NASA-CR-1839) Avail: NTIS CSCL 20E

Refraction plays a very significant role in the absorption of laser energy in high temperature plasmas. The geometry considered is a long cylindrical magnetically confined plasma. The laser pulse is assumed to enter the plasma from the ends. It is then necessary that the radiation propagate the full length of the plasma so that it will be absorbed. The refraction of the laser radiation in the plasma column then depends on the radial distribution

of the density. Several representative density profiles are considered and solutions for the propagation are presented. It is shown that a profile with the maximum density on the axis is very difficult to heat over long distances, but if the density has a minimum on the axis then the plasma column acts like a light pipe and traps the laser beam. In this case the effective absorption length of the laser beam is also reduced. Author

N71-30113# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
NEW MONTE CARLO METHOD AND REVIEW OF PRESENT METHODS FOR CALCULATING THE CHARACTERISTICS OF EXCITATION GEOMETRIES FOR SOLID STATE LASERS
E. J. Seppi Dec. 1970 76 p refs
(Contract DAHC15-67-C-0011)
(AD-722337; IDA/HQ-70-11620; RP-P-655) Avail: NTIS CSCL 20/5

Excitation geometries which have been used to transfer pumping radiation from the source to the active medium of lasers are reviewed and literature cited. Methods of analysis and simplifying assumptions used to calculate the characteristics of excitation geometries are discussed. A three-dimensional Monte Carlo calculation which accounts for interactions that affect the pump light and its distribution in the cavity and active medium of the laser is presented. The calculation accounts for the spectrum, polarization, and intensity distribution of the pump light and the reflection and fraction of the cavity, source, and active medium. The photon trajectories are traced through multiple reflections and refractions by the components of the system until they are absorbed. Absorption in the active medium is based on the absorption coefficient as a function of frequency and on a ground state ion density where account is taken for excitation of active ions to the excited states and for return to the ground state by spontaneous and stimulated emission. Results are presented for various cavity and crystal geometries. Author (GRA)

N71-30114# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ADVANCES IN LASER PUMPING TECHNOLOGY
John F. Asmus Dec. 1970 32 p refs
(Contract DAHC15-67-C-0011)
(AD-722338; IDA/HQ-70-11996; RP-P-713) Avail: NTIS CSCL 20/5

The early years of laser research were characterized by a search for new active media and new transitions. Although progress is continuing in these areas, much of the emphasis has shifted to the advancement of pumping technology. To a considerable extent this shift in emphasis reflects a maturing process taking place in the laser field in response to a fuller understanding of real and potential laser applications. This paper discusses the manner in which pumping technology has evolved and expanded in moving toward higher laser performance and the realization of a broader range of applications. Foremost among these developments are chemical and gas-dynamic excitation in gases, sensitization and spectral matching in optically pumped solids, face-pumped disc technology, and high-pressure discharge excitation. Also described is the manner in which these and other techniques have emerged to advance the state of the art in peak power, average power, efficiency, or other performance parameters. No attempt is made to include intermediate pumping methods involving laser pumped lasers or nonlinear optics. Author (GRA)

N71-30153# Avco-Everett Research Lab., Everett, Mass.
EFFECTS OF 10.6 MICRON LASER INDUCED AIR CHEMISTRY ON ATMOSPHERIC REFRACTIVE INDEX
A. D. Wood, M. Camac, and E. T. Gerry Jul. 1970 35 p refs
(RR-350) Avail: NTIS

The effects of atmospheric absorption of a 10.6 micron laser beam were studied, and it was shown that this absorption can either heat or cool the air, depending upon atmospheric conditions. The absorption, which is predominantly by H_2O and CO_2, induces vibrational trasitions in these molecules. For H_2O the excess vibrational energy is rapidly transferred to the translational mode, causing the air to heat. The situation for CO_2 is more complicated, as several reactions are involved and the corresponding vibrational relaxation times are much slower. The kinetic model for the vibrational relaxation processes is described and an approximate analysis is developed. Numerical results are presented which indicate that significant ray displacement may result as a consequence of the vibrational lag. This effect is shown to increase with increasing altitude and decreasing relative humidity and ambient temperatures. Author

N71-30161# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
INVESTIGATIONS OF FUNDAMENTAL LASER PROCESSES. VOLUME 1: COMPUTATION OF VIBRATION-ROTATION MATRIX ELEMENTS FOR DIATOMIC MOLECULES
Robert E. Meredith and Fred G. Smith May 1971 35 p refs
(Contract DAHC15-67-C-0062; ARPA Order 236)
(AD-722696; Rept-84130-39-T(1)) Avail: NTIS CSCL 7/4

Emmision and absorption of radiation by diatomic molecules is reviewed, and elementary molecular theory for use in a variety of applied physics and engineering problems is presented in a semiclassical manner. A computer code for the numerical integration of the radial Schrodinger equation has been created and is documented as a subroutine of a code for the computation of the electric dipole-moment matrix elements of diatomic molecules. The effect of the vibration-rotation interaction on high v-J matrix elements is discussed. Author (GRA)

N71-30199# National Bureau of Standards, Boulder, Colo. Quantum Electronics Div.
DESIGN FOR A VARIABLE-OUTPUT-COUPLING FAR-INFRARED MICHELSON LASER
J. S. Wells, K. M. Evenson, L. M. Matarrese, D. A. Jennings, and G. L. Wichman Jan. 1971 25 p refs
(NBS-TN-395) Avail: SOD $0.50

A technique for varying the coupling of power from far-infrared gas lasers and the design and construction of these lasers are described. The coupling method is based on Michelson's interferometric principle and permits a continuously variable coupling of the available power from the laser. The present laser design is the result of evolution over the last year and a half. Author

N71-30200# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF NONLINEAR PROPAGATION AND CHIRPING OF SHORT CO_2 LASER PULSES Annual Summary Report, 1 Apr. 1970 - 31 Mar. 1971
David C. Smith, Paul J. Berger, Carl M. Ferrar, Stephen Marcus, and John H. McCoy 30 Apr. 1971 90 p refs
(Contract N00014-69-C-0308)
(AD-722812; UARL-K920832-3) Avail: NTIS CSCL 20/5

The experimental and theoretical program is directed toward obtaining short pulses at 10.6 micron wavelength and studies of the interaction of these pulses with absorbing and amplifying media. Two new passive Q-switching agents for CO_2 were discovered, and also N_2O was passively Q-switched for the first time. Continuous mode-locking of a dc discharge CO_2 laser is reported, and self-mode and saturation pulse sharpening have lead to a pulse of 10 nsec duration, the shortest obtained with dc excited CO_2 lasers. Mode-locking an atmospheric pressure electrically pulsed CO_2 laser has resulted in the generation of pulses as short as 2 nsec. Two new high pressure lasers have been operated utilizing the cross-excited electrically pulsed excitation scheme. Neutral argon (1.59 micrometer wavelength) and Freon-12 (1.79 micrometer) lased.

producing peak powers of about a kilowatt with a pulse duration of 0.2 micro sec. Experimental investigations of flowing metal vapor lasers have been undertaken using a vaporization-condensation flow concept to overcome the self-quenching caused by the long-lived metastable lower laser level at high repetition rates. The concept has been demonstrated using lead, and the experimental technique is discussed. Author (GRA)

N71-30285# Brown Univ., Providence, R.I.
KINETIC THEORY OF AN OPTICALLY PUMPED GAS
T. F. Morse and J. W. Cipolla, Jr. Apr. 1971 46 p refs Prepared in cooperation with Max-Planck-Inst. fur Stromungsforschung, Gottingen, West Ger.
(Contract F44620-71-C-0030)
(AD-722862; AFOSR-TR-71-1097) Avail: NTIS CSCL 7/4

Kinetic equations are presented which successfully incorporate the effects of atomic line radiation on the spatial and time evolution of the velocity distributions of a radiating gas. The equations are applied to the steady state optical excitation of a free molecular slab of two level atoms in a model of the optically excited laser amplifier. Iteration on the coupled kinetic equations and equation of radiative transfer is used to construct a first approximation to the velocity distributions in the optically thick limit. This corresponds to integral iteration in kinetic theory. By performing certain quadratures over the first order velocity distribution for particles in the excited or upper lasing state, it is possible to calculate the inversion density as well as all the radiative properties of the gas. An asymptotic theory is given for the density in the limit of weak external radiation and for two wall reflectance conditions. Also an interesting bimodal behavior of the emission profile is seen. The line shape of the emitted radiation is constant in the line core for about one Doppler width, then it reaches a sharp peak before a Gaussian decay in the far wings. Author (GRA)

N71-30361# Joint Publications Research Service, Washington, D.C.
HOLOGRAPHY AND ITS APPLICATION IN AVIATION AND COSMONAUTICS
V. Frolov and Yu. Soluyanov 22 Jun. 1971 8 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), No. 4, 1971 p 44-45
(JPRS-53420) Avail: NTIS

The principles of holography are briefly outlined and possible applications of light beams in three dimensional imagery for aviation and space flight are discussed. Considered are: aerial holographic photography, saturation air space mapping for flight control, terrain relief mapping, holographic indicators for blind landing systems, holographic flow visualization methods, and holographic detection of camouflaged objects. G.G.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-29202# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
PLUTONIA/CURIA COMPATIBILITY TESTING Quarterly Report, Oct. - Dec. 1970
R. L. Andelin and J. D. Watrous Jan. 1971 16 p
(Contract AT(45-1)-2138)
(MDC-G-2033; QR-9) Avail: NTIS

Microhardness measurements reaffirmed previously reported metallographic and electron beam microprobe results for plutonia/refractory metal combinations exposed at 1800 and 2000 C. Curia exposed at 2000 C for 1000 hours is being examined metallographically. Exposure continues at 1800 and 2000 C on plutonia-238/refractory metal, curia-244/refractory metal, and plutonia-molybdenum cermets. Test matrices have been established and materials ordered for more systems oriented test programs utilizing several plutonia fuel forms in contact with a variety of materials. Author (NSA)

N71-29203# Utah Univ., Salt Lake City.
THERMAL CONVERSION OF INTERSTITIALS IN ELECTRON IRRADIATED COPPER
H. M. Simpson, A. Sosin, and S. L. Seiffert [1970] 18 p refs
(Contract AT(11-1)-1800)
(COO-1800-15) Avail: NTIS

A study by internal friction measurements was made on high-purity copper of the effects of 1-MeV electron irradiation on the rate of addition of point defects to dislocations in the temperature range 78 to 400 K. A distinct minimum in the point defect pinning rate was observed at about 160 K. It was also observed that a peak in the decrement as a function of irradiation time occurred, having a peak position time dependence which reflected the rate at which point defects arrived at dislocations. The above observations are discussed and taken as direct experimental evidence in support of the thermal conversion model. The maximum in internal friction and the minimum in the pinning rate are accounted for in a model of damping due to the dragging of points defects by dislocations. Author (NSA)

N71-29205# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
REFRACTORY ALLOY COMPATIBILITY WITH PLUTONIA-238 AT HIGH TEMPERATURE Interim Report
R. L. Andelin and J. D. Watrous Feb. 1971 63 p refs
(Contract AT(45-1)-2138)
(MDC-G-2034) Avail: NTIS

Several preliminary conclusions have been reached concerning refractory alloy compatibility with plutonia-238 at high temperatures. Exposure to two plutonia impurity levels, two plutonia oxygen composition levels, and three to six refractory metal alloys at 2000 C for 1000 hours or 1800 C for 2000 hours has resulted in a variety of attack mechanisms. Evaluation by metallographic, microhardness, and electron beam microprobe techniques has been used to identify the mechanisms and provide a basis for selecting compatible combinations. Exposure continues toward a scheduled 15,000 hours at 1800 C, after which the final report will be released. Author (NSA)

N71-29212# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
GALVANIC CORROSION BEHAVIOR OF URANIUM ALLOYS IN HYDROCHLORIC ACID AND OCEAN WATER
James M. Macki and Robert L. Kochen 24 Feb. 1971 9 p refs
(Contract AT(29-1)-1106)
(RFP-1592) Avail: NTIS

The galvanic corrosion behaviors of a selected group of alloys in ocean water and hydrochloric acid (HCl) were determined by measuring the gravimetric corrosion rates of galvanically coupled specimens and by constructing a galvanic series for each environment from electrode potential measurements. Based on the gravimetric galvanic corrosion tests, the galvanic series of the alloys tested, in the order of increasing nobility in 0.1 N HCl at 70 C is: 7178 Al, Tuballoy (depleted uranium), U-4.5 Nb, Type 4340 steel, U-6 Nb, U-8 Nb, U-7.5 Nb-2.5 Zr (Mulberry), U-10 Mo, Ti-6 Al-4 V, and type 304 steel (passive). Although they were adjacent to each other in the galvanic series, the type 4340 steel caused the U-4.5 Nb alloy to corrode an order of magnitude faster than the other more noble metals in the series in 0.1 N HCl at 70 C. Author (NSA)

N71-29237# Sandia Labs., Albuquerque, N.Mex.
EFFECT OF CHLORIDE IONS ON THE SUSCEPTABILITY TO STRESS CORROSION CRACKING OF U-7 1/2 wt PERCENT Nb-2 1/2 wt PERCENT Zr AND U-4 1/2 wt PERCENT Nb ALLOYS
Nicholas J. Magnani, Herman Romero, and Charles J. Miglionico Dec. 1970 23 p refs
(SC-RR-70-860) Avail: NTIS

The effect of chloride ions on the stress corrosion cracking behavior of U-7 1/2 wt % Nb 2 1/2 wt % Zr (Mulberry) and U 4 1/2 wt % Nb was studied in this investigation. The fracture mode and critical stress intensity for stress corrosion cracking K sub ISCC) of Mulberry were strongly dependent on chloride concentration. A mixed transgranular (quasi-cleavage) and intergranular mode was observed in Mulberry tested in solutions of 2 ppM Cl; this type of cracking had a K(ISCC) value of 15 KSI/in. An intergranular mode was observed on samples tested in 50 ppM chloride solutions and this type of cracking had a K(ISCC) value of 5 KSI/in. For the binary alloy neither the fracture mode nor K(ISCC) was a strong function of the chloride content of the solution. A transgranular mode was observed in binary alloy samples tested in 2 ppM chloride solutions, and either a transgranular or a mixed transgranular plus intergranular mode was observed in samples tested in 50 ppM chloride solutions. The K(ISCC) value for cracking in solutions of both chloride concentrations was approximately 15 KSI/in. Author (NSA)

N71-29253 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRODEPOSITION OF MAGNETICALLY HARD ALLOYS
V. M. Zhogina et al 3 Nov. 1970 11 p refs Transl. into ENGLISH from Tr. Chetvertogo Soveshch. po Elekirokhim., Moscow, 1956 (Moscow), 1959 p 506 511 In ENGLISH and RUSSIAN
(NLL-LTI-746-641-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Techniques are described for electrodepositing two nonporus Co-Ni coatings, uniform in thickness and structure, for magnetic recording. One coating has a coercive force of 200 to 260 oersteds and the other has a coercive force of 600 to 800 oersteds; both have residual inductions of 4000 to 6000 gauss. The effects of temperature, current density and pH of the electrolyte on the composition of the deposits, and magnetic properties were investigated. The electrolytes studied were nickel sulfate, cobalt sulfate, nickel chloride, cobalt chloride, boric acid, and potassium chloride. The high coercive coating is recommended for a registration of impulses where erasing is conducted by a continuous magnetic field. The low coercive coating is recommended when high frequency erasing arises during measuring. N.E.N.

N71-29275# Bureau of Mines, Washington, D.C.
EFFECTS OF ROLLING TEMPERATURE AND TITANIUM CONTENT ON CREEP AND OTHER PROPERTIES OF ZINC-TITANIUM AND ZINC-COPPER-TITANIUM ALLOYS
L. A. Neumeier and J. S. Risbeck Jun. 1971 35 p refs
(BM-RI-7522) Avail: Issuing Activity

The properties and anisotropy of rolled Zn-Ti and Zn-1.0 wt pct Cu-Ti alloys containing up to 0.36 wt pct titanium are evaluated. Finish rolling was at varied temperatures to total reductions as high as 92 pct. Alloy properties are very sensitive to various combinations of composition, rolling temperature, and reduction. Properly rolled Zn-1.0 Cu-Ti alloys are superior in strength to Zn-Ti alloys. Conditions are described that lead to best tensile properties. Creep resistance for Zn-Ti alloys decreases with increased rolling temperature when finish rolled to 92-pct total reduction, but not when finish rolled to 33- or 67-pct reduction. Creep resistance for Zn-1.0 Cu-Ti alloys improves with increased rolling temperature to about 480 F. Heavily cold-rolled Zn-1.0 Cu-Ti alloys have fine grain sizes and poor hardness, tensile, and creep properties, but high ductility. Thermal expansivity is markedly affected by the copper addition. Data show the anisotropy of tensile, creep, and thermal expansivity properties. Author

N71-29276# Bureau of Mines, Washington, D.C.
CHARACTERISTICS OF ELECTROWON AND OF HYDROGEN-REDUCED MOLYBDENUM POWDER AND SHEET
E. F. Ferrell and H. G. Iverson Dec. 1970 32 p refs
(BM-RI-7455) Avail: Issuing Activity

Electrowon molybdenum powders and a commercial hydrogen-reduced powder, all with different minor impurities, were investigated with respect to inherent properties, fabrication techniques, and properties of the fabricated sheet. Compared with the commercial hydrogen-reduced powder, the electrowon powders had a larger particle size, a greater flow rate, a higher apparent density, and a lower oxygen content. Sheet materials prepared from the two types of powders showed similar mechanical properties, under the same conditions of heat treatments, except for low-temperature ductility. Yield strengths varied with carbon content, heat treatment, and test temperature. Author

N71-29279# Bureau of Mines, Denver, Colo.
BERYLLIUM Preprint from the 1969 Bureau of Mines Minerals Yearbook
Donald E. Eilertsen [1969] 8 p refs
Avail: SOD $0.10

A review of beryllium production, consumption, and utilization for the year 1969 is presented. Bertrandite from Utah was developed as a new commercial source and a competitor of imported beryl. Production of beryllium metal and beryllium oxide were moderately high, and outputs of beryllium-copper master alloy and beryllium aluminum were the second highest on record. Beryllium and ceramic industries consumed 8,483 tons of beryl, with the U.S. government continuing to provide the biggest market for beryllium. Consumers' stockpiles increased over 1968, while exports of unwrought and wrought beryllium metal and alloys, as well as waste and scrap were 69 percent below those in 1968. Internationally, Afghanistan's pegmatites, particularly the Darra-i-Pec beryl deposits have been proven one of the largest reserves in the world, while field reports indicate that beryl recoveries at Indian mines are of high quality. A.C.R.

N71-29280# Bureau of Mines, Washington, D.C. Div. of Nonferrous Metals.
ALUMINUM Preprint from the 1969 Bureau of Mines Minerals Yearbook
John R. Lewis and V. Anthony Cammarota, Jr. [1970] 24 p refs
Avail: SOD $0.15

Production, consumption, and utilization of aluminum in the U.S. during 1969 is reviewed. Progress is reported in the overall industry, with domestic production of primary metal at an alltime high. Apparent consumption also was at the highest rate, and prices for the metal rose two cents per pound over the year. In domestic production, Washington continued to lead, while reduction plant capacity increased at a number of installations throughout the country. Considerable progress in recovery and use of secondary aluminum followed an existing trend. Stockpiles of aluminum ingot for primary producers at year end were significantly reduced, but secondary ingot inventories were up 14 percent over the previous year. The rising trend in aluminum prices was supported. U.S. foreign trade in aluminum turned strikingly during the year, reversing the recent trade balance. Imports of metal fell sharply below those of 1968, while exports rose 64 percent. The world's primary aluminum output showed another substantial increase, rising 12.5 percent above that of the previous year at a rate far in excess of the annual average increases for the 1960's. A.C.R.

N71-29284# Bureau of Mines, Spokane, Wash.
ANTIMONY Preprint from the 1969 Bureau of Mines Minerals Yearbook
L. E. Davis Washington [1969] 11 p refs
Avail: SOD $0.10

Production, consumption, and use of antimony are reviewed. Topics discussed include mine production, smelter production, industrial requirements, foreign trade, and prices. F.O.S.

N71-29297# Bureau of Mines, Washington, D.C. Div. of Nonferrous Metals.
CADMIUM Preprint from the 1969 Bureau of Mines Yearbook
Donald E. Moulds [1969] 8 p ref
Avail: SOD $0.10

Domestic and world production and consumption rates of cadmium are presented. The sales of government held stocks in 1969 to meet the demands are reviewed along with the trends in production, consumption, imports, exports, and prices in the United States. The largest single use of cadmium is for electroplating. The uses of cadmium compounds are discussed and include pigments and thermoplastic stabelizers. F.O.S.

N71-29300# Bureau of Mines, Washington, D.C. Div. of Nonferrous Metals.
PLATINUM-GROUP METALS Preprint from the 1969 Bureau of Mines Minerals Yearbook
Charles D. Hoyt and J. Patrick Ryan [1970] 13 p refs
Avail: SOD $0.10

The production, consumption, and uses of the platinum-group metals are reviewed. Topics discussed include domestic production, sales and prices, onhand stocks, and foreign trade. F.O.S.

N71-29386# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Abteilung Technologie.
ON THE RECRYSTALLIZATION BEHAVIOR OF A TUNGSTEN-RHENIUM ALLOY, DISPERSION HARDENED BY THORIUM OXIDE, IN COMPARISON WITH PURE TUNGSTEN [UEBER DAS KRISTALLISATIONSVERHALTEN EINER MIT THORIUMOXID DISPERSIONSGEHAERTETEN WOLFRAM-RHENIUM-LEGIERUNG IM VERGLEICH ZU REINEM WOLFRAM]
Majda Majdic and Guenter Wirth Dec. 1970 51 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-80) Avail: NTIS; ZLDI Munich: 15,90 DM

The recrystallization behavior of powder metallurgically produced undoped tungsten and W-3Re-2ThO2 was investigated by X-ray diffraction, hardness tests, metallographic and electron microscopy techniques. The dispersion hardened alloy recrystallizes from 100 to 400 C higher temperatures than tungsten, depending on degree of cold working, and it shows no secondary recrystallization up to 2400 C. Its recrystallized grains are extended in the rolling direction due to the strings of particles. In spite of their loss of natural stability, this effect of particles on the recrystallization behavior remains up to 2400 C. The results are summarized in a recrystallization diagram for both materials. Author (ESRO)

N71-29387# Battelle Inst., Frankfurt am Main (West Germany).
RESULTS OF A FEASIBILITY STUDY FOR A NATIONAL MATERIALS DATA BANK OF THE FEDERAL REPUBLIC OF GERMANY
W. Oberender 1970 15 p Presented at the 2nd Intern. Codata Conf. on Generation, Collection, Evaluation, and Dissemination of Numerical Data for Sci. and Technol., St. Andrews, Scotland, 7-11 Sep. 1970
Avail: NTIS

The objectives of this study are outlined and the methods used described. The goals and requirements are considered in detail and an evaluation of the storage capacity given. The number of enquiries is critically examined and the information flow (both input and output) described. Finally proposals are made for the gradual establishment and implementation of the materials data bank. ESRO

N71-29435# Technische Hogeschool, Delft (Netherlands). Vliegtuigbouwkunde.
THE DETERMINATION OF INTERNAL STRESSES IN ROLLED PLATE BY ETCHING OFF THIN LAYERS [HET BEPALEN VAN DE INWENDIGE SPANNINGEN IN GEWALSTE PLAAT DOOR MIDDEL VAN HET WEGETSEN VAN DUNNE LAGEN]
F. Hospers and L. B. Vogelesang Aug. 1969 25 p In DUTCH
(VTH-155) Avail: NTIS

A method for determining the residual stresses in a rolled plate is described. The method is based on progressively etching away the material. This leads to deformation from which the residual stress distribution over the cross section can be calculated. These stresses appear to be great at the surface in the rolling direction, and are always positive. ESRO

N71-29451*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA SPACE SHUTTLE TECHNOLOGY CONFERENCE. VOLUME 2: STRUCTURES AND MATERIALS
Washington Apr. 1971 626 p refs Conf. held at Hampton, Va., 2-4 Mar. 1971
(NASA-TM-X-2273; L-7738) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

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2. REUSABLE EXTERNAL INSULATION TPS FOR THE SPACE SHUTTLE P. D. Gorsuch, R. A. Tanzilli, and D. E. Florence (GE, Philadelphia, Pa.) p 39-93 (See N71-29453 17-31)

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5. ABLATIVE THERMAL PROTECTION SYSTEMS L. F. Vosteen and C. M. Pittman (NASA. Langley Res. Center, Langley Station, Va.) p 163-194 refs (See N71-29456 17-31)

6. ABLATIVE LEADING EDGE DESIGN CONCEPTS FOR THE SHUTTLE ORBITER J. W. Graham, D. A. Mosher, and I. Victor (Grumman Aerospace Corp.) (Avco Corp., N.Y.) p 195-231 (See N71-29457 17-31)

7. BOOSTER THERMAL PROTECTION SYSTEM EVALUATION A. M. Norton (Martin Marietta Corp., Denver, Colo.) p 233-249 (See N71-29458 17-31)

8. THE HEAT SINK CONCEPT FOR THE SPACE SHUTTLE BOOSTER J. Prunty (Gen. Dynamics/Convair, San Diego, Calif.) p 251-269 (See N71-29459 17-31)

9. COMPARISON OF ACTIVE AND PASSIVE THERMAL PROTECTION SYSTEM WEIGHTS FOR A DELTA BODY ORBITER H. D. Schultz and F. L. Guard (Lockheed Missiles and Space Co., Sunnyvale, Calif.) p 271-300 ref (See N71-29460 17-31)

10. ENVIRONMENTAL TESTING FOR EVALUATION OF SPACE SHUTTLE THERMAL PROTECTION MATERIALS AND SYSTEMS H. K. Larson, F. J. Centolanzi, N. S. Vojvodich, H. Goldstein, M. A. Covington and Fred W. Matting (NASA. Ames Res. Center, Moffett Field, Calif.) p 301-333 (See N71-29461 17-31)

11. COMMENTS ON THE NASA DESIGN CRITERIA DOCUMENT I. G. Hedrick (Grumman Aerospace Corp., Bethpage, N.Y.) p 335-354 refs (See N71-29462 17-31)

12. STRUCTURAL ANALYSIS AND AUTOMATED DESIGN H. G. McComb, Jr. (NASA. Langley Res. Center, Langley Station, Va.) p 355-390 refs (See N71-29463 17-31)

13. CRITICAL STRUCTURAL DESIGN TRADE STUDIES SPACE SHUTTLE SYSTEM T. P. Brooks (McDonnell-Douglas Co., St. Louis, Mo.) p 391-465 (See N71-29464 17-31)

14. APPLICATION OF BERYLLIUM TO ORBITER PRIMARY STRUCTURE T. J. Harvey and A. E. Trapp (Lockheed Missiles and Space Co., Sunnyvale, Calif.) p 467-495 (See N71-29465 17-31)

15. DESIGN, MANUFACTURE AND TESTING OF A TD NICKEL-CHROMIUM STRUCTURAL ASSEMBLY R. Johnson, Jr. and C. L. Ramsey (AFFDL) (McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.) p 497-525 (See N71-29466 17-31)

16. DESIGN AND TEST OF ADVANCED STRUCTURAL COMPONENTS AND ASSEMBLIES E. E. Engler and C. E. Cataldo (NASA. Marshall Space Flight Center, Huntsville, Ala.) p 527-583 (See N71-29467 17-31)

17. HIGH TEMPERATURE FASTENER TECHNOLOGY F. D. Boensch, W. H. Goesch, and A. M. Norton (Martin Marietta Corp.) (AFSC, Wright-Patterson AFB, Ohio) p 585-599 ref (See N71-29468 17-15)

18. BEARINGS, LUBRICANTS, AND SEALS FOR ACTUATORS AND MECHANISMS R. L. Johnson, W. R. Loomis and Lawrence P. Ludwig (NASA. Lewis Res. Center, Cleveland, Ohio) p 601-632 refs (See N71-29469 17-15)

For Vol. 1 See N71-26051 through N71-26073 and for Vol. 3 See N71-24651 through N71-24668

N71-29502# Dayton Univ. Research Inst., Ohio.
RESEARCH AND DEVELOPMENT OF RARE EARTH TRANSITION METAL ALLOYS AS PERMANENT MAGNET MATERIALS Semiannual Interim Technical Report, 30 Jun.-31 Dec. 1970
Alden E. Ray and Karl J. Strnat Mar. 1971 53 p refs
(Contract F33615-70-C-1625; ARPA Order 1617)
(AD-722060; UDRI-TR-71-07; AFML-TR-71-53) Avail: NTIS CSCL 9/1

Intermetallic phases with the formules R2Co17, R2Fe17, and R2(Co1-xFex)17 are of potential interest as permanent magnets. Procedures for the preparation of these intermetallic phases are described. Descriptions are given of the design and operation of differential thermal analysis equipment and of a high temperature-high vacuum furnace for the metallurgical and magnetic evaluation of rare earth-transition metal intermetallic phases. Author (GRA)

N71-29517# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
ELECTROCLEANING OF URANIUM ALLOYS
Ross J. Jackson and Charles E. Wickland 16 Mar. 1971 3 p refs
(Contract AT(29-1)-1106)
(RFP-1596) Avail: NTIS

Discussed are the types of surface oxidation products developed on uranium alloys in several environments. The chemical pickling procedures for removal of the surface oxidation products are reviewed. A proven electrochemical procedure for removal of the surface scale is presented and discussed. Author (NSA)

N71-29519# Illinois Univ., Urbana.
PHASE TRANSFORMATIONS INVOLVING INTERSTITIAL ORDERING IN THE VANADIUM NITROGEN SYSTEM
Donald Irwin Potter Feb. 1971 186 p refs
(Contract AT(11-1)-1198)
(COO-1198-798) Avail: NTIS

Alloys of vanadium containing up to 14.0 atomic percent nitrogen were examined in the as-quenched and aged conditions. X-ray diffraction showed the room temperature material to be body centered cubic for nitrogen contents of less than 6.9% and body centered tetragonal for nitrogen contents greater than 7.4%. Electrical resistivity, measured during quenching, also indicated a change in behavior near 6.0% nitrogen. Transmission electron microscopy was used to follow the progress of aging in alloys containing less than 6.0% nitrogen. The matrix remained cubic and the interstitial nitrogen atoms in the matrix were not ordered. The structure of the precipitate was determined from selected area diffraction patterns and consisted of an ordered array of nitrogen atoms in a body centered tetragonal vanadium sublattice. A macroscopic shape change as well as audible clicking accompanied the transformation in alloys containing between 6.0% and 8.0% nitrogen. Author (NSA)

N71-29548# Army Weapons Command, Rock Island, Ill. Research and Engineering Directorate.
APPLICATION OF ATOMIC ABSORPTION SPECTROPHOTOMETRIC TECHNIQUES TO THE ANALYSIS OF STAINLESS STEELS
Elizabeth A. Peterson Feb. 1971 25 p refs
(AD-721896; AMSWE-RE-71-5) Avail: NTIS CSCL 11/6

Methods of analysis for nickel, cobalt, aluminum, and titanium in stainless steels by the use of aqueous standards are described. The various methods of sample dissolution are discussed, as are standard preparation and instrument parameters. Some preliminary work on the analysis for chromium is also included. Analytical results of NBS stainless steel chip standards indicate good agreement with the certified values. Author (GRA)

N71-29647# Pennsylvania State Univ., University Park. Ordnance Research Lab.
THE ELECTROCHEMICAL AND CORROSION BEHAVIOR OF ALUMINUM
George A. Di Bari Washington Naval Ordnance Systems Command 18 Jun. 1970 92 p refs
(Contract N00017-70-C-1407)
(AD-722165; TM-703-02) Avail: NTIS CSCL 11/6

The electrochemical behavior of high-purity aluminum was studied to clarify the corrosion behavior of the metal when exposed to oxygen-free and oxygen-saturated saline solutions of varying pH. The mixed or corrosion potential, E sub M, of the electropolished high-purity aluminum decreases as the pH is increased except in the intermediate pH range (4 to 8) where E sub M increases. A local maximum in the corrosion potential curve as a function of pH is thus observed. Potentiostatic polarization data obtained at pH 4.0 suggest that the rate of dissolution of high-purity aluminum is nearly independent of electrode potential over a fairly wide range, relatively insensitive to the presence of dissolved oxygen in the electrolyte, and highly sensitive to changes in pH. Dissolved oxygen influences the type of corrosion when cathodic potentials are applied. Based on the potentiostatic data, a corrosion diagram believed to be valid for sodium chloride solutions from pH 0 to pH 14 has been constructed. The corrosion diagram is consistent with the observed relation between EM and pH, and also yields estimates of the rate of dissolution of aluminum as a function of pH. The results appear to be consistent with the Pourbaix Diagram for the aluminum-water reaction and with the dissolution-reprecipitation mechanism for the dissolution of aluminum recently proposed by Vedder and Vermilyea. Author (GRA)

N71-29648# Maryland Univ., College Park. Engineering Materials Group.
SOME EFFECTS OF HYDROSTATIC PRESSURE IN METALS AND ALLOYS AND ITS USE IN METAL FORMING PROCESSES
Peter J. Worthington Dec. 1970 33 p refs
(Contract N00014-67-A-0239-0011)
(AD-722416; TR-2) Avail: NTIS CSCL 13/8

The paper considers some of the effects of hydrostatic

pressures in metals and alloys. A complete description is not given but rather an attempt is made to point up some of the more important effects and their possible application to new industrial processes. Author (GRA)

N71-29683 Ohio State Univ., Columbus.
THE OXIDATION MECHANISM OF THE Ni-Cr-Al ALLOYS
Robert Kosak, Jr. (Ph.D. Thesis) 1969 135 p
Avail: Univ. Microfilms Order No. 70-14060

Gravimetric measurements, metallography, X-ray analysis and electron diffraction analysis were used to determine the mechanism of oxidation and the morphology of scale formation on Ni-15 to 20 wt % Cr-2 to 6 wt % Al alloys in oxygen at 1000 C to 1200 C. The oxidation of alloys containing less than 4 wt % Al occurred by the simultaneous internal oxidation of aluminum and the eventual formation of an external scale of Cr_2O_3. The oxidation of alloys containing greater than 4 wt % Al occurred by the simultaneous external oxidation of nickel and chromium and the internal oxidation of aluminum. The eventual formation of a Cr_2O_3 external scale lowered the oxygen partial pressure at the metal/oxide interface which caused the transition from internal to external oxidation of aluminum and the eventual formation of an external Al_2O_3 scale. The addition of chromium to Ni-Al alloys was found to decrease the aluminum concentration necessary for transition and Wagners theory for solute enrichment in the internal oxidation zone of ternary alloys was confirmed for Ni-Cr-Al alloys. Dissert. Abstr.

N71-29686 National Lending Library for Science and Technology, Boston Spa (England).
DUCTILITY AND STRENGTH OF Ni-Cr ALLOYS
S. I. Bulat et al 20 Apr. 1970 11 p refs Transl. into ENGLISH from Fizika i Khim. Obrab. Mat. (USSR), Mar.–Apr. 1969 p 139–144 In RUSSIAN and ENGLISH
(NLL-Trans-746-439-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of an investigation of some mechanical properties of industrially pure binary Ni-Cr alloys, depending on their chemical composition, are given. At low temperatures, the character of strength and ductility change with chemical composition satisfies the law for binary systems with a limited solubility of one component in the other. In the temperature range of hot deformation, an anomalous passage of strength and ductility curves was observed. Thus, the binary phase alloys were super-ductile at 800 to 1200 C. As a result of hot deformation, half finished products were obtained from nickel alloys with a maximum Cr content of up to 49% (eutectic composition). Forging of the alloys with a higher chromium content was not possible because of their extremely low ductility in a cast state. The external form of the ingot from a nickel alloy with 53% chromium, after the first hammer blows, is shown. Author

N71-29688 National Lending Library for Science and Technology.
THIN FILMS: THERMAL ELIMINATION OF DISCONTINUITIES IN THIN FILMS OF GOLD FORMED BY EVAPORATION IN A VACUUM
J. J. Belhache et al 1970 5 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 269, 22 Sep. 1969 p 539–542
(NLL-PORS-Trans-2674-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Results are given of studies of the changes of resistance of thin layers of gold formed by evaporation during vacuum annealing, when the temperature was increased proportionally with the time. The reduced resistance observed is explained by the elimination of discontinuities at the boundaries of the islands or of the cavities. Author

N71-29705 National Lending Library for Science and Technology, Boston Spa (England).
HYDRIDE ORIENTATION IN ZIRCALOY TUBES IN RELATION TO DEFORMATION, TEXTURE AND STRESS [HYDRIDORIENTIERUNG IN ZIRCALOY-ROHREN IN ABHAENGIGKEIT VON VERFORMUNG, TEXTUR UND SPANNUNGEN]
E. Scholzke 30 Jun. 1970 21 p refs Transl. into ENGLISH from J. Nucl. Mater. (Amsterdam), v. 30, 1969 p 324–336 In GERMAN and ENGLISH
(NLL-Risley-Trans-1912-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The interaction of stresses and texture on the normal plane positions of zirconium hydride precipitations were investigated in thin walled Zircaloy 2 and 4 tubes by hydride experiments on stressed samples of different textures. The quantity of hydrogen absorbed was determined by the pressure fall in the hydrogen atmosphere during hydriding and the sample weight changes. Precipitations were made visible for angular position determination by chemical etching and anodic oxidation. Heat treatments up to 500 C had no effect on the positions, but irregular arrangements occurred above 600 C. Stresses only influenced precipitation directions within specific angular regions depending on the type of sample manufacturing. A model of the interactions of stress and texture is presented. J.M.

N71-29713*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF HIGH-GAS-VELOCITY AND STATIC OXIDATION BEHAVIOR OF FUSED-SALT-ALUMINIDED IN 100 BETWEEN 1038 C AND 1149 C
William A. Sanders, Charles A. Barrett, and Hubert B. Probst Washington Jul. 1971 28 p refs
(NASA-TN-D-6400; E-6072) Avail: NTIS CSCL 11F

Electrolytic-fused-salt-process- (EFSP-) aluminided IN 100 was cyclically oxidation tested in high-velocity combustion gas and static air from 1038 to 1149 C (1900 to 2100 F). The 0.064 mm (2.5-mil) nickel aluminide surface layer resulting from the EFSP treatment protected IN 100 for at least 400 hr at 1038 C (1900 F) and 240 hr at 1093 C (2000 F) in the high velocity combustion gas. This protection was similar to that provided by commercial pack aluminizing. At 1149 C (2100 F) protection was less than 20 hr for the EFSP-aluminided IN 100. Author

N71-29726 Illinois Univ., Urbana.
SUB-GRAIN BOUNDARY CORROSION IN ALUMINUM CONTAINING SMALL AMOUNTS OF IRON AND COPPER
Lester Ellsworth Hendrickson (Ph.D. Thesis) 1969 99 p
Avail: Univ. Microfilms Order No. 70-13348

Sub-boundary corrosion has been studied in polygonized polycrystalline specimens of aluminum containing various concentrations of iron and copper impurities exposed to 10% HF as well as 18% HCl solutions. Despite the higher general corrosion in HF the two solutions produced almost identical results. It was found that some form of iron segregation was required to produce pitting and sub-boundary delineation, but an iron content as low as 0.15 ppm was sufficient to produce sub-boundary delineation if the specimens were cooled slowly (17 C/hr) from 650 C. Quenching from selected temperatures during a fast furnace cool showed that the temperature at which sub-boundary corrosion susceptibility developed was almost constant and independent of iron content. Pits along sub-boundaries varied in depth but reached a maximum of 2-1/2 to 3 microns which did not increase with time. It is suggested that pits nucleate at iron clusters which have formed along dislocation lines. Dissert. Abstr.

N71-29773*# General Electric Co., Cincinnati, Ohio
SNAP-8 REFRACTORY BOILER DEVELOPMENT:

CORROSION OF OXYGEN CONTAMINATED TANTALUM IN NaK

R. W. Harrison Washington NASA Jul. 1971 39 p refs (Contract NAS3-10610) (NASA-CR-1850; GESP-138) Avail: NTIS CSCL 18N

The SNAP-8 Refractory Metal Boiler Development Program was continued. It was observed that tantalum specimens with oxygen concentration of 270 ppm or greater are attacked by NaK at 1200 and 1300 F; that welding tantalum specimens in helium containing up to 250 ppm air had an observed effect on their corrosion resistance to NaK; and that reduction of the oxygen concentration of tantalum specimens occurred during NaK exposure, whether the specimens were attacked or not. Author

N71-29812# Watervliet Arsenal, N.Y.

EFFECT OF SIZE AND ORIENTATION ON FATIGUE CRACK GROWTH RATE IN 4340 STEEL

Francis A. Heiser and Walter Mortimer Mar. 1971 54 p refs (AD-722728; WVT-7112) Avail: NTIS CSCL 11/6

Fatigue crack growth rate in 4340 is evaluated from the viewpoint of the effect of orientation and specimen thickness. It is shown that orientation has little effect on the relation between crack growth rate and stress intensity factor. This differs markedly from data on mild steel which showed a marked effect of orientation. The difference is interpreted in terms of the relative cleanliness of the 4340 steel. Increasing the specimen thickness from 1/16 inches to 1/2 inches caused a significant increase in the value of m in the relation da/dN alpha times delta K to the m power, viz. 2.6 to 5.1. This is believed to show an effect of stress state in that, in the thicker specimens, fracture is flat and the stress state tends more toward plane strain. The data show that applying crack growth data from thin specimens to larger structural members can be misleading. Author (GRA)

N71-29828 National Lending Library for Science and Technology, Boston Spa (England).

MORPHOLOGY AND HOMOGENEOUS PRECIPITATION IN A Co-9 PER CENT AT Ti ALLOY

O. E. Tkachenko et al 19 Jan. 1971 11 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (USSR), v. 29, no. 4, 1970 p 834 840 (NLL-CE-Trans-5524-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An electron microscope investigation was performed on the nature of the distribution of particles of the gamma phase with homogeneous precipitation in a Co-9% at Ti alloy. It was found that in the initial stages of decomposition the nuclei of the gamma phase are distributed randomly in the solid solution. It was seen how with increase in temperature of aging they became aligned along directions 100 > of the matrix and then a spatial network is formed with edges parallel to the cubic directions. This variation in position of the particles of the gamma phase during decomposition of the alloy is explained by the elastic interactions between them. Author

N71-29850 Brown Univ., Providence, R.I.

ELECTRICAL AND MAGNETIC PROPERTIES OF SOME POTASSIUM MOLYBDENUM BRONZES

David Steven Perloff (Ph.D. Thesis) 1969 160 p Avail: Univ. Microfilms Order No. 70-8776

The electrical and magnetic properties of the potassium molybdenum bronzes were investigated. An anisotropy in the electrical resistivity of approximately 1-1/2-2 orders of magnitude was observed throughout the temperature range 80-340 K. A change from semiconducting to metallic behavior, which occurs at about 180 K, was also sensitive to sample orientation. Semiconducting to metallic transition is attributed to a small activation energy for donor electrons which permits a large number of electrons to enter the conduction band at a relatively low temperature. A general solution for one-electron two-center overlap integrals is provided for a magnetic model in which electrons spin-pair on special molybdenum sites which are in a sense isolated from the bulk of the structure. Dissert. Abstr.

N71-29884 Wisconsin Univ., Madison

OPTICAL AND X-RAY STUDIES OF METAL SURFACES ERODED BY HIGH-VOLTAGE, OSCILLATOR SPARK DISCHARGES

Stephen Wiley Brewer, Jr. (Ph.D. Thesis) 1969 340 p Avail: Univ. Microfilms Order No. 70-3485

The problem of physical and chemical changes which occur in metal samples as a result of sampling by high voltage, oscillatory spark discharges has been studied. An electronically controlled, high voltage, oscillatory spark source has been modified to deliver single sparks, which may be terminated after one, two, three, four, or six complete current half cycles. Physical and chemical changes resulting from sampling of a variety of alloys by sparks of varying numbers of half cycles have been studied by photomicrography and electron probe microanalysis. Physical effects of trains of sparks on polished electrode surfaces have been observed. The problem of preferential spark sampling of a volatile major element in an alloy has been quantitatively studied by electron probe microanalysis. Dissert. Abstr

N71-29885 Michigan Univ., Ann Arbor.

QUANTITATIVE METALLOGRAPHY AND ELASTIC PROPERTIES OF MODEL TWO-PHASE CONTINUOUS MICROSTRUCTURES

Paul Lawrence White (Ph.D. Thesis) 1969 165 p Avail: Univ. Microfilms Order No. 70-14579

The analysis of isotropic two-phase structures which contain the minor phase located in channels at the junction of three or more grains or cells is presented. By employing open celled polyurethane and metallic foams combined with an infiltrating matrix, a macroscopic model was constructed which was investigated from two broad areas: (1) direct comparisons of two dimensional (planar) and three-dimensional (volume) data; and (2) measurement of elastic properties of such models and the property structure relationships. By quantitative metallography techniques and three-dimensional measurements, the cellular structure of these foams was found to fit most closely the shape of a pentagonal dodecahedron, a twelve-faced polyhedron having five edges per face. Dissert. Abstr

N71-29888 National Lending Library for Science and Technology, Boston Spa (England).

STRUCTURAL CHANGES DURING CREEP OF A NICKEL CHROMIUM ALLOY

V. V. Levitin et al 20 Apr. 1970 9 p refs Transl. into ENGLISH from Sb. Tr. Ukr. Nauchn.-Issle. Spets. Stalei. Splavov i Ferro-Splavov (Ukrainia), no. 2, 1968 p 133 136 In ENGLISH and RUSSIAN (NLL-Trans-746-339-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Structural changes during creep of a Nichrome type alloy by X-ray diffraction were studied. After mounting the sample, attainment of the given temperature (500 C) and lines (200) and (220) on the angle of reflection were obtained. Copper E sub alpha emission with an aluminum filter was used. The investigated curves were constructed along the points across every 5' or 10' of the angle of winding of an indicator. The number of impulses along the electromechanical indicator was determined at each point every 30 sec. The structural changes during creep were considered according to the change of the width of the line and its integral intensity. Author

N71-30110# Systems Science and Software, La Jolla, Calif.

DISLOCATION DYNAMICS AND THE FORMULATION

OF CONSTITUTIVE EQUATIONS FOR RATE DEPENDENT PLASTIC FLOW IN METALS Final Technical Report, Jan. 1969 - Sep. 1970

H. E. Read, J. R. Triplett, and R. A. Cecil Dec. 1970 118 p refs

(Contract DASA01-70-C-005)

(AD-722314; DASA-2638; SR-502) Avail: NTIS CSCL 20/12

A rate-dependent constitutive model is developed which describes a broad spectrum of elastic-plastic response in isotropic metals, ranging from quasi-static behavior through the thermally activated intermediate strain rate regime, up to the high strain rate region where phonon viscosity and relativistic effects appear to control the flow process. Upon reverse straining from a plastically prestrained state, the constitutive model exhibits a rate-dependent Bauschinger effect. An attempt has been made to utilize, wherever possible, current knowledge in the theory of dislocation dynamics in formulating the constitutive model. In most cases, only simple models of governing deformation mechanisms can be constructed and, even to accomplish this, considerable speculation sis required. Where dislocation theory is unable to provide guidance in defining and characterizing a particular mechanism, a phenomenological approach has been followed. The advanced constitutive model developed here has been incorporated into the one-dimensional, finite-difference RIP code. The application of this model to 6061-T6 aluminum is described. Author (GRA)

N71-30112# RAND Corp., Santa Monica, Calif.

THE THERMO DYNAMICS OF THE TITANIUM/TITANIUM VAPOR SYSTEM

F. J. Krieger Mar. 1971 46 p refs

(Contract DASA01-71-C-0012)

(AD-722341; DASA-2624; R-660-DASA) Avail: NTIS CSCL 11/6

The purpose of the study is the thermodynamic investigation of titanium, Ti, over a range of temperatures up to 6000K and pressures up to 1000 atmospheres. Two sets of equilibrium composition equations are used--one representing a pure gas phase, the other a heteorogeneous system of gas and condensed (i.e., solid or liquid) titanium. The gas phase of the heterogeneous Chemical system, like the homogeneous gas phase, comprises 3 gaseous species. The results of the computational program are presented in both tabular and graphic form. The latter comprises (a) a conventional Mollier diagram in which specific enthalpy is plotted against specific entropy, with cross plots of temperature, pressure, and molecular weight or moles of condensed titanium, (b) a plot of volume versus temperature for titanium, and (c) a plot of vaporization temperature for titanium, aluminum, and graphite at various pressures. Author (GRA)

N71-30124# Technische Hochschule, Darmstadt (West Germany). Fakultaet fuer Mathematik und Physik.

CONSTRUCTION OF A VIBRATORY MAGNETOMETER AND SUSCEPTIBILITY MEASUREMENTS ON EuYb ALLOYS AND ON Gd DOPED Ni3Al [AUFBAU EINES VIBRATIONSMAGNETOMETERS UND SUSZEPTIBILITAETSMESSUNGEN AN EUYB-LEGIERUNGEN UND AN MIT GD DOTIERTEM NI3AL]

Karl-Hans Unterreiner (Ph.D. Thesis) 19 Dec. 1969 67 p refs In GERMAN

Avail: NTIS

Oscillating magnetometer measurements on EuYb alloys and Gd doped Ni3Al alloys are reported. Electron spin resonance values and conduction electron susceptibility data of the alloys are used to calculate the exchange integers between isospins and conduction electrons and bonding between isospins. Comparison of high temperature magnetizations for pure Ni3Al and Gd doped Ni3Al does not show significant differences; low temperature and high magnetic field strength magnetizations of the doped and undoped alloys proceed in similar fashion. Small magnetic field and low temperature magnetization produced antiparallelism in conduction electron and Gd ion positions so that the polarization density of the conducting electrons around the Gd ion increases. Magnetic susceptibility of EuYb alloy depends very much on the temperature regime and europium concentrations. Transl. by G.G.

N71-30151*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Systems Research Dept.

STRESS CORROSION CRACKING STUDIES INVOLVING ALUMINUM ALLOY SINGLE AND BICRYSTALS (PROJECT BIXTAL) Final Report, 30 Jun. 1969 - 30 Jul. 1970

Thaddeus J. Fabiniak Jun. 1971 54 p refs

(Contract NAS8-25053)

(NASA-CR-119849; CAL-KC-2857-P-1) Avail: NTIS CSCL 11F

Experimental techniques and growth conditions for bi-crystals of Al, Al - 4.5% Cu, Al - 5.6% Zn and Al - 4.5% Cu - 1.5% Mg compositions have been established. The bi-crystals are characterized with regard to the grain boundary direction, precipitate phase distribution, and misorientation angle. The data strongly indicate that the misorientation angle can be related to the degree of precipitate phase in the microstructure of the as-grown bi-crystals. Author

N71-30197# Royal Aircraft Establishment, Farnborough (England).

INVESTIGATIONS INTO THE DEFORMATION BEHAVIOUR OF ALUMINUM MATERIALS AT DIFFERENT TEMPERATURES [UNTERSUCHUNGEN UEBER DAS UNFORMVERHALTEN VON ALUMINIUMWERKSTOFFEN BEI VERSCHIEDENEN TEMPERATUREN]

Rudolf Akeret Jan. 1971 21 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 61, no. 1, 1970 p 3-10

(RAE-Lib-Trans-1489) Avail: NTIS

Up to about 200 C, the deformation behavior of aluminum alloys is determined by the cold working parameters: high flow-stress and pronounced strain rate. Above 200 C, the transition to hot-working behavior, with pronounced softening and predominant influence of the rate is observed. In alloys, the type and amount of components in solid solution determine the flow stress. Manganese increases the maximum of the flow stress in the first part of the stress-strain curve. The ductility may be interpreted in terms of its dependence on rate and temperature by assuming different fracture mechanisms. The prevailing mechanism is characterized by fracture at minimum strain in a given strained state. Author

N71-30248+ National Aerospace Lab., Amsterdam (Netherlands).

THE REPAIR OF FATIGUE CRACKS IN LOW ALLOY STEEL SHEET

H. P. van Leeuwen, L. Schra, and A. E. Meulman Feb. 1970 53 p refs

(NLR-TR-70029-U) Avail: NTIS

Fatigue cracks were grown in rectangular specimens with a central notch. At a certain crack length, the crack was repaired, using a variety of methods. Fatigue loading was resumed and re-initiation and subsequent growth of the fatigue crack were studied. The repair methods evaluated comprised simple stopholes, brazed straps across the crack, plugs brazed into the stopholes, plastically stretched stopholes and Brinell dimples at the crack tips. The last two methods were the most successful. Stretching the stopholes constituted the best compromise between simplicity and effectiveness. Author

N71-30249# Royal Aircraft Establishment, Farnborough (England).

THE EFFECT OF MICROSTRUCTURE AND TEMPERATURE ON THE YIELD STRESS OF ALUMINIUM AND ALUMINIUM-MAGNESIUM ALLOYS [STRECKGRENZENVERHALTEN VON ALUMINIUM UND ALUMINIUM-MAGNESIUM-LEGIERUNGEN BEI VERSCHIEDENEN GEFUEGEZUSTAENDEN UND TEMPERATUREN]

H. Borchers et al Feb. 1971 23 p refs Transl. into ENGLISH from Aluminum (Duesseldorf), v. 44, no. 1, 1968 p 47-51
(RAE-Lib-Tran-1512) Avail: NTIS

The effect of foreign atoms on the deformation behavior of a pure metal under uniaxial tension has been investigated, using aluminium and aluminium magnesium alloys. The system aluminium magnesium is particularly suitable for these measurements, since, in spite of precipitation when the magnesium content exceeds 1.9 wt.-%, it is only after very long storage times that any significant hardening effect is shown through this addition. By variation of the grain size, distribution of foreign atoms, and test temperature, it is possible to obtain a difference in the degree of supersaturation. The effect of the various test parameters on flow stress and strain is also considered. Author

N71-30250# California Univ., Livermore. Lawrence Radiation Lab.
PRECIPITATION HARDENING OF MO-1 at PERCENT Hf BY INTERNAL NITRIDING
J. B. Mitchell, L. Himmel, and J. S. Kane 19 Oct. 1970 27 p refs Sponsored by AEC
(UCRL-50958) Avail: NTIS

Precipitation hardening of 0.050-in.-thick sheets of a Mo-1 at. % Hf solid solution alloy was accomplished by internal nitriding which produced a homogeneous dispersion of coherent plate like HfN precipitates oriented on [001] planes of the molybdenum matrix. The high temperature tensile strength of this alloy is substantially superior to that of TZM and TZC. During internal nitriding, growth of the HfN particles occurs at the advancing nitriding front by Ostwald ripening which produces an increase in average particle size with increasing depth below the external surface. The high nitrogen activity in the alloy behind the nitriding front effectively inhibits dissociation and growth of the precipitates. The plate-like HfN particles grow in diameter in a coherent manner. Thickening of the particles occurs by the nucleation and growth of coherent ledges on the planar surfaces. Author (NSA)

N71-30251# New Mexico Inst. of Mining and Technology, Socorro. Dept. of Metallurgical and Materials Engineering.
FRACTURE CHARACTERISTICS IN EXPLOSIVELY LOADED POLYCRYSTALLINE COPPER Technical Report, 31 Jan. 1970-1 Feb. 1971
Ching H. Ma 12 Apr. 1971 30 p refs
(Contract N00014-67-A-0267-0003)
(AD-722339; MT-71-3; TR-3) Avail: NTIS CSCL 11/6

Copper specimens were explosively loaded by two different methods. The experimental results show that in one method the specimens were fractured mainly by the reflected tensile waves while in the other the specimens were essentially fractured by unreflected shock waves. The reasons for these differences are advanced. The deformation characteristics associated with the explosively loaded specimens are also reported and commented upon. Author (GRA)

N71-30351 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRON MICROSCOPIC STRUCTURES OF IRON-MANGANESE ALLOYS [TETSU-MANGAN GOKIN NO DENSHI KENBIKYO SOSHIKI]
K. Suemune et al Feb. 1971 13 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Japan), v. 30, no. 5, 1966 p 428-434
(NLL-RTS-6321) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 1.10; 4 NLL photocopy coupons

The microstructure of the epsilon phase formed in the heat treatment process of Fe-Mn alloys is studied. Three kinds of manganese iron alloys of different manganese content are examined by thin film electron microscopy. The results are: In the water quenches structure of 18.3% Mn alloy epsilon and gamma are coexistent, and the epsilon phase is present at various thicknesses in a lamellar state along with the [111] face of the gamma phase. In furnace quenching of this alloy the epsilon crystals are considerably extended compared with those of the water quenched structure and internal faults are somewhat less frequent. Author

N71-30380# Royal Aircraft Establishment, Farnborough (England).
THE FATIGUE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. 2: THE EFFECT OF IMPURITIES, SURFACE CONDITIONS AND TEST CONDITIONS ON THE FATIGUE STRENGTH [UEBER DAS DAUERSCHWINGVERHALTEN VON TITAN UND SEINEN LEGIERUNGEN. 2: EINFLUSS VON VERUNREINIGUNGEN DES OBERFLAECHENZUSTANDES UND DER PRUEF BEDINGUNGEN AUF DIE WECHSELFESTIGKEIT]
M. Hempel Oct. 1969 29 p refs Transl. into ENGLISH from Draht (Coburg/Ofr.), v. 16, no. 4, 1965 p 209-218
(RAE-Lib-Tran-1399) Avail: NTIS

The effects of the following factors on the fatigue strength of commercially pure titanium and a number of commercial and non-commercial titanium alloys are reviewed: (1) the presence of interstitial (O, H, N, C) and substitutional (Al, Sn) impurities; (2) whether the test piece is cut longitudinally or transversely to the rolling or forging direction; (3) various surface conditions, such as turning, milling, grinding and shot blasting, giving surface compressive or tensile residual stresses, chemical surface treatments, plating and electro polishing; and (4) different test conditions, such as test frequency, cooling with tap water, and sodium chloride solution for Part 1, see N71-30126. Author

N71-30381# Royal Aircraft Establishment, Farnborough (England).
THE FATIGUE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. PART 4: THE EFFECT OF STRESSING MODE
M. Hempel Jan. 1971 60 p refs Transl. into ENGLISH from Draht (West Germany), v. 17, no. 5, 1966 p 332-337
(RAE-Lib-Trans-1533) Avail: NTIS

The fatigue strength of titanium and titanium alloys determined by various stressing modes (plane bending, rotating bending, direct stress and torsional loading) are reviewed. Alternating bending gave fatigue strength-tensile strength ratios of 0.5-0.6 while direct stress and torsional loading gave ratios between 0.3 and 0.45. A comparison is made between the results for these various stressing systems in order to explain these differences in fatigue strength. The effect of notches is also discussed, particularly for rotating bending. Author

N71-30382# Royal Aircraft Establishment, Farnborough (England).
THE FATIGUE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. PART 6: THE FATIGUE STRENGTH OF BOLTED, RIVETED AND WELDED JOINTS
M. Hempel Jan. 1971 33 p refs Transl. into ENGLISH from Draht (West Germany), v. 18, no. 2, 1967 p 89-98
(RAE-Lib-Trans-1535) Avail: NTIS

The fatigue strength of bolted, riveted and welded joints is reviewed. The various factors affecting the fatigue behavior of bolted joints are briefly described and emphasis is placed on the importance of thread production on the fatigue strength. The most important of the parameters listed which affect the fatigue strength of riveted joints is the notch effect due to the rivet hole. A detailed discussion is then given of the fatigue strength of spot-welded and, particularly, butt welded joints. The effect of the position of the weld seam with respect to the rolling and stressing directions is described. In addition the effects of post weld annealing and working of the weld bead are discussed. Finally the effect of the size, number and distribution of pores on the fatigue strength is dealt with and it is concluded that the microstructure of the heat affected zone is the controlling influence in determining the fatigue strength of titanium and titanium alloys. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-29219# Battelle Memorial Inst., Columbus, Ohio.
FABRICATION AND CHARACTERIZATION OF BINDERLESS GRAPHITE Final Report
Fred P. Kirkhart Mar. 1971 28 p Prepared for Sandia Labs.
(SC-CR-70-6169) Avail: NTIS

Hot isostatic compaction at 3000 F and 30,000 psi was used to successfully prepare single-phase bulk graphite specimens for ablation testing. Both calcined oleum and calcined non-needle cokes yielded suitable specimens, judging by density, strength, and electrical resistivity measurements. The microstructures were also satisfactory. Diamond yielded low-density specimens (1.65 to 1.70 g per cu cm), but strength, resistivity, and microstructure were excellent. Although specimens produced from graphitized petroleum coke were dense, they were disappointing from a density-strength viewpoint and also because of high resistivity. Thermax was processed into high-intensity, strong, but highly carbonaceous material. Neither carbonized nor graphitized polyphenylene yielded suitable materials for ablation testing. Author

N71-29264 Bureau of Mines, Washington, D.C.
IMPACT OF CHANGING TECHNOLOGY ON REFRACTORIES CONSUMPTION
David J. Kusler and Robert G. Clarke 1970 74 p refs
(BM-IC-8494) Avail: SOD $0.70

The impact of changing technology on the supply and demand of refractories is discussed, based on a literature review and survey of leading consumers and producers of such materials. Results indicate that the percentage distribution of refractories sales to the consuming industries has remained essentially constant during the last decade, but that substantial changes have occurred in the relative distribution of types of refractories. The trend in pyroprocessing technology in recent years has been toward higher temperatures, which require more costly refractories. This fact is reflected in the impressive gain in the dollar value of refractories sales, which in 1968 was about one-third greater than in 1960, and the rapid growth of refractories based on high-alumina, magnesia, zirconia, carbon, and other materials, at the expense of fire clay, silica, and chrome-based refractories. Refractories value and shipment data are also tabulated in a manner by which trends in the distribution of refractory types can be observed from 1955 to 1968. In addition, unit values are presented on a per-ton basis for comparison. Author

N71-29265# Sandia Corp., Albuquerque, N.Mex. Materials Development and Analysis Div.
DEVELOPMENT AND TESTING OF A CARBON/CARBON COMPOSITE FABRICATED BY CHEMICAL VAPOR INFILTRATION OF A FILAMENT-WOUND SUBSTRATE
J. D. Theis, Jr. Apr. 1971 17 p refs Presented at the 5th Symp. on Advanced Composites, St. Louis, 6 Apr. 1971 Sponsored by AEC
(SC-DC-70-5369; CONF-710407-1) Avail: NTIS

The development and testing of a carbon/carbon composite fabricated by chemical vapor infiltration of a filament-wound substrate is reported. These composites are characterized by high resistance to thermal erosion, shock resistance, and improved strength at high temperatures and are utilized as construction materials for thin-walled conical shells. Material performance tests yielded the following results: (1) The tensile stress-strain curves of the composite are linear to failure when the loading direction is nearly transverse to filament direction. At intermediate angles, the relations are nonlinear, and the load-carrying capabilities are beyond those of initial yielding. (2) The tensile modulus varies as a function of filament orientation. (3) The ultimate tensile strength decreases as the angle between the loading direction and filament direction increases. A.C.R.

N71-29278# Bureau of Mines, Washington, D.C. Div. of Nonferrous Metals.
BAUXITE Preprint from the 1969 Bureau of Mines Minerals Yearbook
John R. Lewis [1970] 15 p refs
Avail: SOD $0.10

A review of bauxite production, consumption, and uses for the year 1969 is presented. An 8.5 percent increase in U.S. aluminum production to an alltime high in 1969 manifested itself throughout the domestic bauxite and alumina sectors, with three states, Arkansas, Alabama, and Georgia, again producing the entire bauxite output. During the year, 87 percent of all bauxite used in the U.S. was imported for primary use in aluminum production and secondary utilization in abrasive, refractory, and chemical industries. Crude and processed stock for this material decreased in value, while the price remained stable for bulk-form bauxite and calcined alumina. The average value of crude, undried, domestic bauxite shipments rose again in 1969, and exports of bauxite and aluminum concentrates decreased about 28 percent with a sizable increase in value per ton. Worldwide bauxite production made a 14 percent annual gain, continuing an existing trend. A.C.R.

N71-29317# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
METHODS FOR THE VISCOSITY DETERMINATION OF HETEROGENEOUS SYSTEMS [METHODEN ZUR VISKOSITAETSBESTIMMUNG HETEROGENER SYSTEME]
H. Pfoertner 30 Jun. 1970 50 p refs In GERMAN
(ICT-12/70) Avail: NTIS

The difficulties in viscosity measurements of explosive and solid rocket propellant substances are discussed. New methods of measurement are described which provide reliable data on the rheological properties of such heterogeneous mixtures. Experiments were conducted with four disperse systems covering a large range of viscosity values, so that the results can be applied to suspensions of any composition. ESRO

N71-29356# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
MOLECULAR WEIGHTS AND MOLECULAR WEIGHT DEPENDENT PARAMETERS OF POLYVINYL NITRATES [MOLEKULARGEWICHTE UND MOLEKULARGEWICHTSABHAENGIGE KENNGROESSEN VON POLYVINYLNITRATEN]
K. M. Bucerius 4 Sep. 1970 22 p refs In GERMAN
(ICT-5/70) Avail: NTIS

Practical use of polyvinyl nitrates depends upon knowledge of the molecular weight since many physical properties of polymers depend on this. The methods of obtaining average values from molecular weight measurements are discussed, as well as the results. ESRO

N71-29503 National Lending Library for Science and Technology, Boston Spa (England).
THE CREEP BEHAVIOUR OF GLASS-FIBRE REINFORCED POLYESTER RESIN LAMINATES ON NATURAL WEATHERING [DAS KRIECHVERHALTEN VON GLASFASERVERSTARKTEN POLYESTERHARZLAMINATEN BEI FREIBEWITTERUNG]
V. Zilvar May 1970 5 p Transl. into ENGLISH from Kunstoffe

(West Ger.), v. 59, no. 12, 1969 p 948-954
(NLL-Lib-Comm-5196-(1553)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of natural weathering on the creep behavior of glassfiber reinforced polyester resin laminates under bending stress was examined. In the initial stage the progress of creep is similar to that under laboratory conditions, provided the glass/resin bond is good. Due to a higher temperature during the summer months and to water absorption, hair cracks form at the glass/resin interface. When the cracks reach a certain size, they cause a marked rise in the rate of creep and permanent set. Author

N71-29516# Sandia Corp., Albuquerque, N.Mex. Materials Development and Analysis Div.
SANDIA LABORATORIES' CARBON COMPOSITES DEVELOPMENT PROGRAM
J. K. Johnstone [1971] 15 p Sponsored by AEC
(SC-DC-71-3853) Avail: NTIS

The successful test flights of two carbon/carbon composite heat shields have supplied the impetus for a major development and improvement program in carbon/carbon composites. The heat shields represented two material candidates selected after a comprehensive materials evaluation study of a number of carbon composites. The two materials selected were chemical vapor deposition felt and filament wound. The substrate material is a carbon felt or continuous carbon filaments wound in a helical pattern. The matrix carbon is applied by the chemical vapor deposition technique. The carbon composites are subsequently heat treated at temperatures near 3000 C. Emphasis is directed toward materials development, understanding the mechanics of composites, and fabrication development which could lead to substantially improved carbon composite materials. Author

N71-29546# Aerospace Corp., El Segundo, Calif. Lab. Operations.
POLYACRYLONITRILE PRECURSOR FIBERS FOR CONVERSION TO HIGH MODULUS, HIGH STRENGTH FIBERS. VOLUME 1: THERMAL ANALYSIS, OCTOBER 1969 - FEBRUARY 1970
Camille A. Gaulin and Willard R. McDonald 12 Feb. 1971 33 p refs
(Contract F04701-70-C-0059)
(AD-722055; TR-0059(6250-40)5-Vol-1; SAMSO-TR-71-61-Vol-1) Avail: NTIS CSCL 11/9

The chemistry of polyacrylonitrile (PAN) polymers is of particular interest because of the use of these materials as precursors in the formation of high modulus carbon and graphite reinforcement filaments for organic materials in high strength, high stiffness composites. A study has been initiated into the mechanism of thermal degradation of the PAN polymers and has included commercially available yarn prepared from a copolymer of unknown history, and experimental fibers produced from both copolymers and homopolymers. Thermal methods, primarily differential thermal analysis (DTA) and thermogravimetric analysis (TGA), have been used to characterize the changes in decomposition mechanisms of the PAN fibers resulting from oxidative and radiation stabilization. It has been observed that unmodified PAN fibers undergo vigorous exothermic chemical change at moderate temperatures (about 310C). Irradiated PAN generally exhibits the exotherm at a significantly lower temperature. Where the exotherm is absent, this weight loss does not occur and a correspondingly high yield of carbonaceous residue results. Author (GRA)

N71-29666# Boeing Scientific Research Labs., Seattle, Wash.
POLYQUINAZOLOTRIAZOLES
P. N. Hergenrother Mar. 1971 29 p refs
(AD-722246; DI-82-1057) Avail: NTIS CSCL 7/3

A novel high molecular weight (eta(inh) = 1.4 dl/g) polyquinazolotriazole (PQT) was prepared from the reaction of 3,3'-(2",6"-pyridinediyl)bis(5-(o-aminophenyl-1,2,4-triazole) with isophthalic acid by solution cyclopolycondensation in polyphosphoric acid, with diphenyl isophthalate by melt polycondensation, and with isophthaloyl chloride to form a precursor polyamid which subsequently underwent cyclodehydration. Thermal characterization of the PQT by TGA showed initial weight loss in air commencing at about 490 C. The PQT exhibited a weight loss of only 4 % after aging in static air for 200 hr at 316 C and a Tg of 342 C as measured by DSC. Prior to polymer synthesis, a series of model compounds were prepared and characterized. Author (GRA)

N71-29706 Marquette Univ., Milwaukee, Wis.
STUDIES OF THE DEFECT STRUCTURE OF NONSTOICHIOMETRIC BaTiO3
Stanley Arnold Long (Ph.D. Thesis) 1969 209 p
Avail: Univ. Microfilms Order No. 70-11967

A BaTiO3 defect structure which incorporates singly and doubly ionized nonstoichiometric oxygen vacancies and acceptor states of undetermined origin was inferred from the excellent agreement between a theoretically derived relation and the experimentally observed oxygen partial pressure (1 to 10 to the minus 22nd power atm) and temperature (800 to 1215 C) dependence of the conductivity. An n-type conductivity was observed when the concentration of nonstoichiometric defects was relatively large while the conductivity was p-type for relatively small departures from stoichiometry. A band gap energy of approximately 3eV was calculated from the temperature dependence of the conductivity at the p to n transition. The standard enthalpies of formation for defect reactions in BaTiO(3-x) were calculated from the temperature dependence of A' and B' in the theoretical relation. Electronic mobilities of 0.057 and 0.053 cm/Vsec at 1104 and 1215 C, respectively were calculated from the parameters and the thermodynamic data of Panlener. Dissert. Abstr.

N71-29715# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
ON THE PROBLEM OF WATERPROOFING WIRE STRAIN GAUGES AND SEMICONDUCTORS [ZUM PROBLEM DES FEUCHTIGKEITSSCHUTZES VON DEHNUNGSMESSSTREIFEN UND HALBLEITERGEBERN]
Goetz Andreae (Ph.D. Thesis) 1969 77 p refs In GERMAN
Avail: NTIS

The effects of moisture absorption and content on wire strain gauge and semiconductor direct current resistances, carrier frequencies, and swelling properties are outlined and several methods of waterproofing for these devices are considered. Permeation and solubility coefficients of various waterproofing materials are evaluated and the effects of their applications on the mechanical properties of the measuring devices are studied. It is concluded that the most promising protection for wire strain gauges is provided by a laminated plastic layer with a thin metal foil cover; microcrystalline wax coatings proved not satisfactory because of loss of adhesion. Transl. by G.G.

N71-29769# Technische Hochschule, Darmstadt (West Germany). Fakultaet fuer Maschinenbau.
ON ELECTROSTATIC ELECTRIFICATION OF THERMOPLASTIC RESINS DURING SPRAY FORMING [UEBER ELEKTROSTATISCHE AUFLADUNGEN BEIM SPRITZGIESSEN THERMOPLASTISCHER KUNSTSTOFFE]
Wolfgang Loos (Ph.D. Thesis) 1969 168 p refs In GERMAN
Avail: NTIS

The effects of working conditions during spray forming with injection molds as well as resin mass properties and mold materials on static contact electrification of the thermoplastic resins mass are studied. It is shown that the electrification of the resin mass in contact with metal depends on relative dielectricity and negative electricity. Static electrification of dyed plastics is affected by the

kind of additives used and by copoloymers that are sensitive to pressures and temperatures applied during contact with metals. Galvanic nickel and chromium layered molds did not generate statics during the spray forming process. Transl. by G.G.

N71-29771*# TRW Systems Group, Redondo Beach, Calif.
THE DEVELOPMENT OF THERMALLY STABLE ADHESIVES FOR TITANIUM ALLOY AND BORON COMPOSITE STRUCTURES
R. W. Vaughan, R. J. Jones, J. F. Creedon, and J. W. Goodman Washington NASA Jul. 1971 65 p refs
(Contract NAS1-9532)
(NASA-CR-1824; TRW-12006-6012-T0-00) Avail: NTIS CSCL 11A

The work performed to develop thermally stable adhesives for bonding titanium alloy and boron composite substrates is described. TRW A-type polyimide technology was employed as a basis for a series of adhesive formulations evaluated for bonding titanium alloy 6A14V and boron/polyimide composites. It was shown that copolymeric blends of an A-type polyimide and amide–imide resin provided superior adhesive properties at elevated and cryogenic temperatures than state-of-the art adhesives. Data are presented for the most promising adhesive selected on long term elevated and cryogenic aging of bonded assemblies and for stress rupture tests at elevated temperature. Author

N71-29811# British Columbia Univ., Vancouver. Dept. of Electrical Engineering.
PLASMA ANODIZATION Final Technical Report, 5 Nov. 1969 - 31 Oct. 1970
David L. Pulfrey and Lawrence Young Wright-Patterson AFB, Ohio AFAL Mar. 1971 56 p refs
(Contract F33615-70-C-1225)
(AD-722490; AFAL-TR-70-328) Avail: NTIS CSCL 11/3

The anodization of Ta, Nb and Si was carried out in oxygen plasmas generated by both hot and cold cathode discharges and by an externally-coupled r.f. voltage. For the anodization of Nb in a.d.c. cold cathode discharge, the existence of a high field ionic conduction mechanism as the operative growth process has been confirmed. However, on the basis of a simple model for the metal/oxide/plasma system, it appears that under some circumstances the field in the oxide is controlled by the large electronic currents flowing, and furthermore, that the negative oxygen ions relevant to the oxide growth are formed either at the sample surface or in the sheath surrounding it. Anodization in a hot cathode discharge improves the oxide growth rate but introduces problems as regards sample heating and contamination. These latter two factors can lead to reduced quality of the resulting dielectric films. Anodization of Si in an r.f. plasma gives relatively fast growth rates (about 15 A/min) and preliminary data indicate that the mechanism of oxide growth involves an impact ionization process. Author (GRA)

N71-29849 Pennsylvania State Univ., University Park.
THE EFFECT OF IMPURITY DOPINGS AND SURFACE TREATMENTS ON THE ELECTROKINETIC BEHAVIOR OF SILICON CARBIDE
Hok-Shing Liu (Ph.D. Thesis) 1969 229 p
Avail: Univ. Microfilms Order No. 70-13855

The effect of impurity dopings and surface treatments on the electrokinetic behavior of silicon carbide (SiC) have been studied. The SiC samples used in the study consisted of samples specially prepared in the laboratory and different commercial products. The streaming potential method was selected for measuring the electrokinetic (zeta-) potential. Both inorganic and organic (flotation collectors) electrolytes were evaluated. The change in zeta-potential with increasing concentration of the electrolyte in the solution was determined. The point of zero charge (PZC) was of particular interest in evaluating the electrokinetic results. Dissert. Abstr.

N71-29870# North American Carbon, Inc., Columbus, Ohio.
DEEP BED ACTIVATED CARBON FOR LIQUID, SOLID, AEROSOL AND GASEOUS FILTERS
J. L. Kovach and R. G. Newton (MSA Res. Corp., Evans City, Pa.) *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 738 750 refs (See N71-29851 17-13)
Avail: NTIS HC $6.00/MF $0.95

The design of a filtration system for removing both particulate matter and gaseous radioactive contaminants from radioactive gaseous wastes is described. The system uses horizontally placed 15 in. deep carbon beds consisting of coarse activated carbon followed by high efficiency particulate aerosol filters. The results of efficiency tests for particulate removal and for radioactive iodine adsorption are presented. It was concluded that: the design is simple and advantageous because the single containter eliminates extensive gasketing and, therefore, potential leaks; the overall iodine adsorption efficency; the deep filter system permits in situ regeneration of a weathered carbon bed by the introduction of hot inert gas; the hazard of disposal of the contaminated bed is considerably reduced; and the deep bed filter design permits easy continuous monitoring of decontamination efficiency, even during accident conditions, by monitoring activity in the absorber at various levels. NSA

N71-30060 Pennsylvania State Univ., University Park.
CHARACTERIZATION AND APPLICATION OF CATHODOLUMINESCENCE FROM MANGANESE ACTIVATED CARBONATE MINERALS
Sheldon Emanuel Sommer (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms Order No. 70-13889

The cathodoluminescence and X-ray induced luminescence of Mn(+2) activated carbonate minerals were studied utilizing electron microprobe and a source of Cr X-ray radiation. The luminescence produced by electron or photon bombardment was related to the composition and structure of the calcite-magnesite solid solution series, aragonite-strontianite solid solution series, dolomite, vaterite, witherite and otavite. The cathodoluminescence emission varied from approximately 590 millimicrons for calcite to approximately 677 millimicrons for magnesite, illustrating the effect of decreasing bond distance between the alkaline earth cation and the ligands and the resulting increased crystal field splitting parameter. Dissert. Abstr.

N71-30095# National Bureau of Standards, Washington, D.C. Heat Div.
GLASS LIMIT STANDARDS DEPOSITED AT NBS FOR RAILWAY, HIGHWAY AND AIRWAYS TRAFFIC SIGNAL COLORS: HISTORY, PERMANENCE AND COLORIMETRIC PROPERTIES
Geraldine W. Haupt Jun. 1971 126 p refs
(NBS-TN-564) Avail: SOD $1.00

Signal glass limit standards for railway, highway, and aviation colors, selected by user-organizations, are discussed. The first standards were selected in 1931 for railway use. Highway standards were adopted in 1940, and selection of aviation standards began in 1942. The NBS is custodian of 63 standards for these signal colors. Permanence of the filters is examined, based on colorimetric conversions for CIE (International Commission on Illumination) standard illuminant A derived from spectrophotometric measurements made on different instruments over periods of years. Spectral transmittance data and the resulting colorimetric data are given for 9 illuminants ranging in distribution temperature from 1500 to 3250 K and for CIE standard illuminants B and C. Figures show, for several filters of each color, the shifts occurring both in chromaticity and in redness and brightness index with changes in illuminant. Author

N71-30135# Technische Hogeschool, Eindhoven (Netherlands).
ADSORPTION PHENOMENA ON CARBON

Johannes Gerardus Theresia Van Aken (Ph.D. Thesis) 1969 192 p refs
Avail: NTIS

Adsorption phenomena on various carbon adsorbents are investigated and explained in relevant theories or suitable descriptions. Considered are: (1) adsorption isotherms of vapors on homogeneous carbon surfaces; (2) multilayer adsorption on carbon adsorbents; (3) pore structure effects of activated carbons on adsorptivity; (4) density of carbon adsorbents and specific volume of adsorbate in micropores; (5) water vapor adsorption by carbon adsorbents; and (6) mixed adsorption of water and organic substances on activated carbon. G.G.

N71-30178# Coast Guard Academy, New London, Conn. Research and Development Project.
REVIEW OF SYNTHETIC FIBER ROPES: NATIONAL DATA BUOY DEVELOPMENT PROJECT
Walter Paul Aug. 1970 156 p refs
Avail: NTIS

Engineering methods to control the structure of fiber ropes and the ropes reactions to external loads and deformations are established. The reactions of visco-elastic macromolecular synthetic fibers in their complex arrangement in rope structures are considered. The change of rope properties due to environmental influences is also covered. Author

N71-30198# Westinghouse Research Labs., Pittsburgh, Pa.
FRACTURE ENERGY AND STRENGTH BEHAVIOR OF A SODIUM-BOROSILICATE GLASS-Al2O3 COMPOSITE SYSTEM
F. F. Lange 1 Apr. 1971 49 p refs
(Contract N00014-68-C-0323)
(AD-722349; Rept-71-9D2-CERAM-R1; TR-6) Avail: NTIS CSCL 11/4

A significant increase in fracture energy was observed (up to 5 times the fracture energy of the glass without a second phase dispersion). The fracture energy depended on both the interparticle spacing and average particle size of the Al2O3 dispersion. These results could best be explained by a previously proposed model for the interaction of a crack front with a second phase dispersion. Surface roughness also contributed to the increased fraction energy. Some composites exhibited a significant strengthening relative to the glass without a dispersion. Calculated values of the crack size showed that the Al2O3 dispersion increased the crack size of the glass by an amount equal to about 1-3 times the average particle size of the Al2O3 dispersion. Thus, the Al2O3 dispersion increased both the fracture energy and the crack size. These two opposing parameters ultimately determined the strength behavior of these composites. Author (GRA)

N71-30236# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
ENVIRONMENTAL STRESS CORROSION CRACKING OF GLASS
S. W. Wiederhorn Apr. 1971 56 p refs Presented at the Intern. Conf. on Corrosion Fatigue, Chem., Mech. and Microstructure, Storrs, Conn., 14 - 18 Jun. 1971
(Contract NAonr-12-69)
(AD-722692; NBS-10565) Avail: NTIS CSCL 11/2

A review is presented on the effect of environment on the strength of glass. The structure of glass and its strength in the absence of environment are discussed briefly. Experimental results on environmental cracking of glass are presented. Finally, theoretical treatments are given and discussed with respect to available experimental data. Author (GRA)

N71-30252# Naval Ordnance Lab., White Oak, Md.
ACCELERATION OF ALUMINUM FOILS BY SHOCKS IN PMMA
David J. Edwards and John O. Erkman 31 Mar. 1971 31 p refs
(AD-722344; NOLTR-70-266) Avail: NTIS CSCL 11/4

Calculations were performed which give the flow induced in adjoining slabs of PMMA and aluminum as a shock wave propagates through the composite plate. Two cases were investigated: the aluminum foil embedded in the PMMA and the foil on the free surface of the PMMA toward which the shock propagated. In order to simplify the calculations, the shock was driven by a piston, i.e., its amplitude was independent of time. Also simple approximations for the equations of state of the PMMA and aluminum were used. Results were obtained by two methods; an artificial viscosity computer code and a graphical method. Results of these computations give the time required for the foil to acquire the expected velocity. Such data are useful in understanding the rise time observed in the records from the electromagnetic gage method for measuring particle velocity in the detonation of explosives. Author (GRA)

N71-30382# Royal Aircraft Establishment, Farnborough (England).
MODIFICATIONS IN THE FINE STRUCTURE OF POLYACRYLONITRILE FIBRES BY STRETCHING AND THERMAL TREATMENT. PARTS 1 AND 2 [UEBER VERAENDERUNG DER FEINSTRUKTUR VON POLYACRYLNITRILFASERN BEI DER RECKUNG UND DER THERMISCHEN BEHANDLUNG]
G. von Hornuff et al Jan. 1971 49 p refs Transl. into ENGLISH from Faserforsch. u. Textiltech. (Berlin), v. 20, no. 7, 1969 p 309 - 316 and v. 20, no. 8, 1969 p 391 - 399
(RAE-Lib-Tran-1508) Avail: NTIS

Relations have been investigated between the properties of the fibres and the amount of stretching and heat treatment using model and commercial fibres of polyacrylonitrile. The methods employed to investigate the fine structures of the fibres are discussed and evaluated. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-29248# California Univ., Livermore. Lawrence Radiation Lab.
NON-LINEAR SYSTEM CHARACTERIZATION AND ANALYSIS
O. L. Rater Feb. 1971 8 p refs Presented at the 3d Southeastern Symp. on System Theory, Atlanta, 5 6 Apr. 1971 Sponsored by AEC
(UCRL-72980; CONF-710404-1) Avail: NTIS

The derivation of the generalization of Wiener G-Functional theory of nonlinear systems to the case of nonzero mean, otherwise-white, Gaussian processes is given and discussed. Using a given truncation of the infinite functional expansion, a recursive method of solution of the resulting integral equation for the input, given the output, is given and discussed. Author

N71-29312# Southampton Univ. (England). Inst. of Sound and Vibration Research.
LINEAR SYSTEM ANALYSIS BY CROSS CORRELATION AND ITS TRANSFORM TECHNIQUES
F. Kandianis Nov. 1970 63 p refs Sponsored by Min. of Defense
(ISVR-TR-33) Avail: NTIS

The effects of the presence of extraneous noise on the estimates of the cross correlation function and cross spectral density function of the excitation and response, are examined as

well as the effects of the limited bandwidth of the excitation on the estimate of the frequency response of a structure. Analytic expresssions for the cross correlation function and some of its properties are derived for bandwidth limited excitation. An integral transform technique is also applied to the cross correlation function which renders estimates of the frequency response function free from the bandwidth effects of the excitation. The theory developed is illustrated by tests on a simple system. Author (ESRO)

N71-29330# Pennsylvania Univ., Philadelphia. Dept. of Physics.
FUNCTIONAL DIFFERENTIAL EQUATIONS DETERMINING REPRESENTATIONS OF LOCAL CURRENT ALGEBRAS
G. A. Goldin and D. H. Sharp [1970] 25 p refs
(Contract AT(30-1)-2171)
(NYO-2171-326) Avail: NTIS

The problem of finding an irreducible representation of a local current algebra is understood as the problem of solving a functional differential equation. The solution to this equation and how a knowledge of this solution enables one to compute all quantities of physical interest in the theory are considered. The analysis was carried out for a system of noninteracting bosons. NSA

N71-29436# Technische Hogeschool, Delft (Netherlands).
ON GENERALIZATIONS OF FOURIER AND LAPLACE TRANSFORMS
Hendrik Simon Victor De Snoo (Ph.D. Thesis) 24 Mar. 1971 87 p refs
Avail: NTIS

Theorems are proved concerning Watson's generalization of the Fourier transform, and the spectral theory of the transform is given in the space L squared from -infinity to +infinity. A generalization of the Laplace transform is also considered. An inversion formula is proved for integral transforms of which the kernel is a solution of a certain differential equation. Author

N71-29447# North Carolina Univ., Chapel Hill. Dept. of Statistics.
WAVE LENGTH AND AMPLITUDE FOR A STATIONARY PROCESS AFTER A HIGH MAXIMUM
Georg Lingren (Lund Univ.) Feb 1971 23 p refs *Its* Mimeo Series No. 742
(Contract N00014-67-A-0321-0002)
(AD-722004) Avail: NTIS CSCL 12/1

Let the set (epsilon (t)), t an element of R be a stationary, Gaussian process with the covariance function r(t) (r(0) 1, r double prime (0) lambda sub 2), and assume it has a local maximum with height u at t 0. Let tau sub u and delta sub u be wave-length and amplitude, *i.e.* the horizontal and vertical distances between the maximum and the following minimum. The paper deals with the limit distribution of (tau sub u, delta sub u) as u approaches infinity. Author (GRA)

N71-29448# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
A METHOD OF ESTIMATING ERRORS IN EXPERIMENTAL DATA
J. M. Blair Dec. 1970 12 p refs
(AECL-3781) Avail: AEC Depository Libraries

A numerical method of estimating the errors in a set of experimental observations of a function is described. The method is applicable when the measured function is tabulated at equal intervals of the argument and when there is a single experimental observation for each value of the argument. The technique estimates the standard deviation sigma of the experimental error, on the assumption that the standard deviation is the same for groups of adjacent function values. The confidence limits for sigma depend on the number of observations available. Author

N71-29482# Royal Inst. of Tech., Stockholm (Sweden).
STRICT ESTIMATION OF THE MAXIMUM OF A FUNCTION OF ONE VARIABLE
Torsten Stroem [1970] 18 p refs
Avail: NTIS

An algorithm for the strict estimation of max f(x) when f is analytic on I (with x belonging to I), is described. If roundoff is neglected the error bound can be made arbitrarily small by an adaptive implementation. A majorant concept is utilized and an ALGOL program is given. The special application to the strict estimation of the range of a polynomial without any determination of the zeros of the derivative is also outlined. Author (ESRO)

N71-29539# Joint Publications Research Service, Washington, D.C.
METHOD OF LEAST SQUARES IN PROBLEMS OF IDENTIFICATION OF DYNAMIC SYSTEMS
Yu. P. Leonov *In its* Cybernetics and Regulation Theory 18 Jun. 1971 p 11-17 refs (See N71-29536 17-10)
Avail: NTIS

Solutions of a special class of integral Fredholm equations, obtained in the least squares solution of the identification problem, are examined. Two cases are studied: when some point of aberration in the system is accessible to observation, and when only the steady motion of the system is accessible. It is shown that for both cases there is a solution in factor space with an energetic norm. The solution may be ambiguous, but all solutions are equivalent from the point of view of the minimum mean square error. Author

N71-29691# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
ON A CLASS OF SINGULAR INTEGRAL EQUATIONS OF THE FOLDING TYPE [UEBER EINE KLASSE SINGULAERER INTEGRALGLEICHUNGEN VOM FALTUNGSTYP]
Manfred Kremer (Ph.D. Thesis) 1969 75 p refs In GERMAN
Avail: NTIS

Common regulating operators that apply to singular integral equations containing Cauchy transformations and also to Weiner-Hopf equations are considered. Although the nucleus of the integral operator in both types of equations depends only on a difference in argument - or folding equation - the first type of equation provides an equivalent boundary value problem with variable coefficients, whereas the second type of equation needs Fourier transformation for the same boundary value problem. Fredholm operators are developed and used to obtain regulating operators for an equivalence equation with constant coefficients. Transl. by G.G.

N71-29697 California Univ., Los Angeles.
MULTI-COULOMB TYPE EQUATIONS AND A NEW EXPANSION OF THE SCATTERING AMPLITUDE
Teodoro Azzarelli (Ph.D. Thesis) 1969 159 p
Avail: Univ. Microfilms Order No. 70-14256

A general type of O(n + 1) and O(n,1) invariant equations, in the n dimensional Euclidean space, are studied and solved, using properties of the generators and Casimir operators of their invariance groups. These equations and their solutions are investigated, first in momentum space, and then in x space, where they are shown to be multi-Coulomb type equations. A simple expression for the eigenvalues of the equation is obtained, for arbitrary values of beta but the eigenfunctions can be expressed in terms of known functions, only for beta 1. However, several properties, including orthogonality and completeness relation, are obtained for general values of beta. The equation is investigated also for more general potentials, both local and nonlocal, and it is shown, that there exists a set of nonlocal potentials for which the equation is still solvable. Local, nonsolvable, potentials are introduced, and a perturbation analysis is carried for Yukawa type potentials. Also investigated is the possibility of extending the above formalism to the scattering problem, for the Schroedinger equation. Dissert. Abstr.

N71-29720# Technische Hochscule, Darmstadt (West Germany). Fakultaet fuer Mathematik und Physik.
RICHARDSON EXTRAPOLATION AND ERROR ESTIMATION FOR THE NUMERICAL SOLUTION OF SECOND ORDER BOUNDARY VALUE PROBLEMS [RICHARDSON-EXTRAPOLATION UND FEHLERABSCHAETZUNG BEI DER NUMERISCHEN LOESUNG VON RANDWERTPROBLEMEN 2 ORDNUNG]
Ernst Helmut Waldschmidt (Ph.D. Thesis) 1969 73 p refs In GERMAN
Avail: NTIS

The alternating iterative matrix correction method for numerical solutions of boundary value problems is extended through the Richardson extrapolation to obtain an asymptotic solution using even h-potencies for the discretizised problem. The existence of an asymptotic development through even h-potencies is proven and an error estimation is formulated for an improved boundary value approximation that exactly determines the high error order of the extrapolation. This error approximation is based on a fixed point algorithm for semi-ordered spaces. Transl. by G.G.

N71-29733# California Univ., Los Angeles. Dept. of Engineering and Applied Science.
IDENTIFICATION OF LINEAR DYNAMICS SYSTEMS
A. V. Balakrishnan Mar. 1971 10 p refs Presented at the Southeastern Symp. on System Theory (3d), Atlanta, 5-6 Apr. 1971
(Grant AF-AFOSR-1408-68)
(AD-723108; AFOSR-TR-71-1112) Avail: NTIS CSCL 12/1

The identification problem of systems with linear dynamics with state and observation noise is considered. An application to a Flight Control problem is indicated. Author (GRA)

N71-29736 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF THE TRANSIENT AND STEADY STATE STABILITY OF A STEAM SERVOMOTOR LINEAR MODEL BY MATHEMATICAL MODELLING
V. V. Lysko 15 Feb. 1971 17 p refs Transl. into ENGLISH from Energiya (USSR), 1969 p 146-153
(NLL-CE-Trans-5261-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupon

An attempt is made to determine the viability of designing a stable, high speed steam servomotor. A linearized differential equation of motion of such a servomotor is presented together with its solution and analysis on an electronic computer for specific values of the servomotor parameters. Author

N71-29739 National Lending Library for Science and Technology, Boston Spa (England).
METHOD OF IDENTIFICATION OF NONLINEAR UNITS IN A CONTROL SYSTEM
G. Jumarie [1971] 19 p Transl. into ENGLISH from Automatisme (France), v. 14, no. 7-8, Jul.-Aug. 1969 p 293-300
(NLL-CE-Trans-5488-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Two methods for identifying characteristics of nonlinear units of controlled systems are discussed. The first is a method of synthesis, is easy of application and particularly suitable for operations in real time or in a self-regulating system on account of its low time-constants. The second, a more analytical method, is difficult to apply lengthy and costly, but the formulas it uses are particularly suited to problems of synthesis. Author

N71-29772*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORMULAS FOR nth ORDER DERIVATIVES OF HYPERBOLIC AND TRIGONOMETRIC FUNCTIONS
Edwin G. Wintucky Washington Jul. 1971 16 p refs
(NASA-TN-D-6403; E-6327) Avail: NTIS CSCL 12A

Formulas for the derivatives of any order are derived in the form of finite series for the hyperbolic and trigonometric cotangent, tangent, cosecant, and secant. These formulas are useful for the evaluation of Fourier sine and cosine integrals commonly expressed in terms of the derivatives. The coefficients in the series have a simple recursive property which facilitates their calculation. Author

N71-29789# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
NUMERICAL PROCEDURE FOR INVERSION OF INTEGRAL TRANSFORMATIONS [NUMERISCHES VERFAHREN ZUR UMKEHRUNG VON INTEGRAL TRANSFORMATIONEN]
Udo Schendel (Ph.D. Thesis) 1969 72 p refs In GERMAN
Avail: NTIS

An iterative procedure is developed for solving the operator equation Ky = f, where the operator K projects an element of the Hilbert space H definitely into an element f epsilon H. This procedure is used to solve Laplace and Gaussian transformations. Solution to the equation Ky=f is obtained by searching for the original element y epsilon H that is attached to the projecting element f epsilon H under the assumption that for a certain class of projecting elements f also unique solutions y exist. Transl. by G.G.

N71-29814*# Scripta Technica, Inc., Washington, D.C.
VARIATIONAL AND BOUNDARY VALUE PROBLEMS [VARIYATSIONNAYA I KRAYEVAYA ZADACHA]
K. U. Rzayev NASA Jul. 1971 10 p refs Transl. into ENGLISH from Izv., Akad. Nauk Azerb. SSR, Ser. Fiz. Tekhn. i Mat. Nauk. (USSR), no. 3, 1970 p 61-66
(Contract NASw-2036)
(NASA-TT-F-13745) Avail: NTIS CSCL 12A

For a certain class of functionals, under certain supplementary conditions the differential properties of the corresponding generalized solutions of the integrodifferential equations are studied. A justification is given for the variational principle of solving boundary value problems for the class of functionals corresponding to nonlinear integrodifferential equations in the regions whose boundaries may include fewer than N-1 manifolds. Author

N71-29838 Illinois Inst. of Tech., Chicago.
EXISTENCE AND UNIQUENESS OF SOLUTIONS TO THE LOW EQUATION
Harlan Simm McDaniel (Ph.D. Thesis) 1970 128 p
Avail: Univ. Microfilms Order No. 70-13562

Fixed point theorems are used to show that certain crossing symmetric S matrix equations have at least one solution. The methods are illustrated in the case of the one meson Low equation. It is shown to have a nonresonant iterative solution which is unique within a certain set of functions. The solution is analytic in a circle in the complex coupling constant plane. Existence proofs are also given for solutions to the inverse amplitude and N/D formulations of the Low equation. It is proved in each of these three formulations that a sufficient condition for the existence of a solution is that the coupling constant be less than a certain bound which depends on the cutoff and on the crossing matrix. Resonant solutions are studied by explicit introduction of CDD poles into the N/D equations. Existence of a solution involving an arbitrary choice of narrow resonances can be proved. Numerical values are given for the bounds in each of the three formulations of the Low equation. Dissert. Abstr.

N71-29848 Michigan Univ., Ann Arbor.
SYMBOLIC COMPUTER SOLUTION OF ELLIPTIC BOUNDARY VALUE PROBLEMS
Norman Loren Schryer (Ph.D. Thesis) 1969 131 p
Avail: Univ. Microfilms Order No. 70-14636

A study was made of the elliptic boundary value problem: Lu = trine u + a(x,y) u sub x + b(x,y)u sub y + c(x,y)u = 0 with c(x,y) < or = 0 on a simply connected domain D and u = f given on differential D. Under the assumption that the coefficients a, b, and c are analytic functions of x and y, a system of particular solutions, p sub k(x,y), of Lu = 0 is constructed. Each p sub k is given by an infinite series whose elements are defined recursively in terms of a, b, and c. These solutions are independent of the domain D and represent generalizations of the harmonic polynomials Re (x + iy) sup k and Im (x + iy) sup k for the equation trine u = 0. Let p sub k,T be defined by truncating the series expansion of p sub k. Several examples are given and numerical results presented for the special case where a, b, and c are polynomials in x and y.
Dissert. Abstr.

N71-30018 National Lending Library for Science and Technology, Boston Spa (England).
ON A CLASS OF STRATEGIES WHICH CAN BE USED TO PROVE THEOREMS BY THE RESOLUTION PRINCIPLE [OB ODNOM KLASSE STRATEGII, PRIMENYAEMYKH PRI USTANOVLENII DOKAZUEMOSTI METODOM RESOLYUTSII]
N. K. Zamov et al Oct. 1970 13 p refs Transl. into ENGLISH from Zap. Nauch. Seminarov. Lenin. Otdel Mat. Inst. im Steklova. A.N. (SSSR), v. 16, 1969 p 54–64
(NLL-RTS-5857) Avail: Natl. Lending Library, Boston Spa, Engl.: 24s 0d

A class of strategies is described which can be used to construct proofs of formulae of predicate calculus by the resolution principle. A method of proving the completeness of the class is given, and it is shown that the majority of known strategies fall into the class. Formulae of predicate calculus represented in prenex disjunctive normal forms are considered in which the universal quantifiers are eliminated and the existential quantifiers are omitted.
Author

N71-30023*# Maryland Univ., College Park. Computer Science Center.
SIMULATION OF A SINGLE-SERVER MODEL FOR A PAGING DRUM CHANNEL SYSTEM
Gee-yin Kwok Jun. 1971 31 p
(Grant NGR-21-002-197)
(NASA-CR-115179; TR-160) Avail: NTIS CSCL 12A

A single-server model is an abstract mathematical model which can be applied to many systems. The formulation of a single-server model which represents a paging drum channel system is presented. Simulation has been carried out by FORTRAN and SIMULA assuming uniformly distributed inputs.
Author

N71-30035 National Lending Library for Science and Technology, Boston Spa (England).
ON THE SEMANTICS OF MODAL LOGIC [O SEMANTIKE MODALNOI LOGIKI]
G. E. Mints Oct. 1970 8 p refs Transl. into ENGLISH from Zap. Nauchnykh Seminarov Leningrad Mat. Inst. im Steklova Akad. Nauk SSSR (USSR), v. 16, 1969 p 147–151
(NLL-RTS-5860) Avail: Natl. Lending Library, Boston Spa, Engl.: 14s; 2 NLL photocopy coupons

The semantics for modal formulae of the first degree in which necessity is interpreted as meaning demonstrability in the classical computation formulation are discussed. Completeness is proved, relative to this semantics, of the corresponding fragment of computation. In the proof there is established the possibility in a certain sense of an optimal correction of an arbitrary propositional formula.
Author

N71-30061# Northeastern Univ., Boston, Mass. Dept. of Physics.
HARD MESON CURRENT ALGEBRA CALCULATION OF THE GAMMA - 3 PION AMPLITUDE
M. G. Miller May 1971 6 p refs
(NUB-2074) Avail: NTIS

The gamma + pion → pion + pion + pion interaction is considered within the context of hard meson current algebra and a model of PCAC breakdown previously proposed. The form factor for this process is calculated and the gamma - 3pion coupling constant evaluated. The results are in agreement with experimental data.
Author

N71-30131*# Translation Consultants, Ltd., Arlington, Va.
NUMERICAL INTEGRATION OF THE LAWDEN INTERMEDIATE THRUST ARCS AND STUDY OF THEIR OPTIMALITY (IN A NEWTONIAN CENTRAL FORCE FIELD) [INTEGRATION NUMERIQUE DES ARCS A POUSSEE INTERMEDIARE DE LAWDEN ET ETUDE DE LAUR OPTIMALITE (DANS UN CHAMP NEWTONIEN CENTRAL)]
A. Archenti and C. Marchal Washington NASA Jul. 1971 15 p refs Transl. into ENGLISH of French conf. paper ONERA-TP-869
(Contract NASw-2038)
(NASA-TT-F-13748; ONERA-TP-869) Avail: NTIS CSCL 12A

In the local horizontal plane, easily integrable numerically, the intermediate thrust arcs constitute a one-parameter family, from the spiral to the reversible arc. These arcs are studied in detail and are optimal on sufficiently short lengths. In the case of the reversible arc, various comparisons, such as the comparison with the one-impulse transfer of the same duration, indicate that the favorable part of the reversible arc is optimal in totality. Some examples of numerically integrated arcs are presented in symmetrical and non-symmetrical cases, and also in cases with a zero or a non-zero Hamiltonian.
Author

N71-30187# Southwest Research Inst., San Antonio, Tex.
A COMPARISON OF SOME FINITE ELEMENT AND FINITE DIFFERENCE METHODS FOR A SIMPLE SLOSHING PROBLEM
W. H. Chu et al 4 May 1971 20 p refs
(TR-1) Avail: NTIS

A recently developed second-order finite element formula is compared to two other methods of computing fuel sloshing for a two-dimensional rectangular tank. The second-order finite element formula is derivable from Hamilton's principle, and is subject to a zero divergence condition. The other methods are a simple finite difference method and a finite element method based on velocity potential. It is concluded that the finite element method based on the velocity potential with the central differences and the central averages is the most efficient of the three methods. Since simple finite difference methods may be less accurate, a numerical transformation using a high speed computer combined with variational principles may be the most efficient for three-dimensional sloshing. The proposed approach would be approximately a second-order process, provided that suitable mapping is employed.
Author

N71-30217*# Maryland Univ., College Park, Md. Computer Science Center.
CONNECTIVITY AND GENUS IN THREE DIMENSIONS
Chan Mo Park and Azriel Rosenfeld May 1971 20 p
(Grant NGL-21-002-008; Contract AT(40-1)-3662)
NASA-CR-119187; TR-156) Avail: NTIS CSCL 12A

An algorithm is described for assigning labels to connected objects, so that each point of a given object receives the same label, while points belonging to different objects receive different labels. This algorithm can be used to count the objects (number of objects = number of distinct labels used) and to compute their volumes (volume of an object = number of times its label occurs).
Author

N71-30318# California Univ., Los Angeles. Dept. of Mathematics.
SEMIGROUPS OF NONLINEAR TRANSFORMATIONS IN BANACH SPACES

Michael G. Crandall 28 Apr. 1971 30 p refs Presented at the Symp. on Nonlinear Functional Analysis, Madison, Wis., Apr. 1971
(Contract N00014-69-A-0200-4022)
(AD-722708) Avail: NTIS CSCL 12/1

The paper was presented to the Symposium on Nonlinear Functional Analysis sponsored by the Mathematics Research Center, University of Wisconsin, Madison, April, 1971. Recent developments in the theory of nonlinear semigroups are surveyed, with emphasis on the joint work of the author and T. M. Liggett. New applications to certain partial differential equations are sketched. Author (GRA)

N71-30341# Maryland Univ., College Park. Center for Theoretical Physics.
REMARKS ON THE VALIDITY OF THE COTTINGHAM FORMULA
Michael Creutz and Siddhartha Sen Jun. 1971 14 p refs
(Grant NSF GU-2061)
(TR-71-125) Avail: NTIS

The effect of Schwinger terms on the Wick rotation necessary to derive the Cottingham formula for electromagnetic mass shifts is discussed. A simple condition, which allows the construction of a covariant and gauge invariant virtual compton scattering amplitude on which the Wick rotation can be performed is presented. Author

N71-30352# California Univ., Los Angeles. Dept. of Mathematics.
EVANS-TYPE P-HARMONIC FUNCTIONS ON A RIEMANN SURFACE
Kazumitsu Kawai (Ph.D. Thesis) Mar. 1971 90 p refs
(Grant DA-ARO(D)31-124-71-G20)
(AD-722810; TR-53; AROD-9653-13-M) Avail: NTIS CSCL 12/1

In this work the author considers extremal properties of P-harmonic principal functions on a Riemann surface. The existence of an Evans-type P-harmonic principal function on a regular subregion is defined and its construction by the linear operator method is carried out. GRA

N71-30367*# Tennessee Technological Univ., Cookeville.
FOURIER AND STATISTICAL ANALYSIS AT RANDOM WAVEFORMS, PART D Final Project Report
Dennis L. Luckinbill and Andrew Michael Jun. 1971 81 p refs
(Contract NAS9-10385)
(NASA-CR-115075) Avail: NTIS CSCL 12A

The implementation of a computer program which gives frequency information and statistical quantities for experimental data is described. Mathematical formulas used within the program are outlined including filter simulation. Fourier analysis, power spectral density, probability moments, the probability density and chi-square test, and the autocorrelation function. Two examples of program usage are given; the sum of two sine waves of different frequencies and the analysis of a square wave. The analysis of a digital filter is also shown. J.M.

N71-30362 National Lending Library for Science and Technology, Boston Spa (England).
ON NONLENGTHENING APPLICATIONS OF RULES FOR EQUALITY [O NEUDLINYAYUSHCHIKH PRIMENENIYAKH PRAVIL DLYA REVENSTVA]
V. P. Orevkov Oct. 1970 6 p refs Transl. into ENGLISH from Zap. Nauchn. Seminarov Leningrad. Mat. Inst. Im Steklova (USSR), v. 7, no. 34, 1967 p 103 112
(NLL-RTS-5964) Avail: Natl. Lending Library, Boston Spa, Engl: 8s; 1 NLL photocopy coupon

Various proposals concerning the specification of the form of deductions in the Gentzen variants of the calculus of predicates with equality and functional symbols are considered. These proposals are formulated for the classical calculus of predicates with equality and functional symbols, but they can all be transferred without difficulty to the case of constructive (intuitionistic) calculus as well. Author

N71-30372# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
INITIAL-VALUE PROBLEMS FOR THE KROOK EQUATION. 1: THE RAYLEIGH PROBLEM
Daniel S. Watanabe Mar. 1971 28 p refs
(Grants NSF GK-65; NSF GK-1827)
(TR-36) Avail: NTIS

The Volterra integral equations governing the problem are formulated and a numerical method for solving them is described. Accurate numerical solutions are presented and compared with previous results obtained by Chu. These accurate solutions will serve as standards for evaluating the accuracy of approximation procedures used in kinetic theory. Author

N71-30373# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
INITIAL-VALUE PROBLEMS FOR THE KROOK EQUATION. 2: THE PISTON PROBLEM
Daniel S. Watanabe Mar. 1971 24 p refs
(Grants NSF GK-65; NSF GK-1827)
(TR-37) Avail: NTIS

The Volterra integral equations governing the problem are formulated and a numerical method for solving them is described. An accurate numerical solution is presented and compared with other results. This solution will serve as a standard for evaluating approximation procedures in kinetic theory. Author

N71-30374# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
NUMERICAL METHODS FOR VOLTERRA INTEGRAL EQUATIONS
Daniel S. Watanabe Mar. 1971 30 p refs
(Grants NSF GK-65; NSF GK-1827)
(TR-38) Avail: NTIS

The direct methods solve the given integral equation, while the indirect methods solve a related integral equation. Both types are modelled after finite difference methods for ordinary differential equations, but the direct methods are more efficient than the indirect ones. Convergence theorems for these methods and a simple numerical example are presented. Author

N71-30378# Joint Publications Research Service, Washington, D.C.
RENDEZVOUS GAME PROBLEMS
N. N. Krasovskiy 24 Jun. 1971 359 p refs Transl. into ENGLISH of the book 'Igrovyye Zadachi o Vstreche Dvizheniy' Moscow, Nauka Press, 1970 p 1 420
(JPRS-53450) Avail: NTIS HC$6.00/MF$0.95

The differential games aspect of controlled systems theory is discussed. It is the first systematic discussion in Soviet literature of a number of problems connected with studying pursuit and evasion game problems described by ordinary differential equations. The core of the method of solving game problems proposed in the discussion is the rule of extremal guidance developed by the author with consideration of and based on the modern achievements of controlled process theory. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-29266# California Univ., Berkeley. Lawrence Radiation Lab.
WIND DATA SUMMARY, LAWRENCE RADIATION LABORATORY, BERKELEY
John S. Peck, Herbert P. Cantelow, Jensen Young, and Robert M. Latimer Dec. 1970 47 p
(Contract W-7405-eng-48)
(UCRL-20224) Avail: NTIS

Wind data for the 5 year period ending March 1, 1968 is summarized for Building 4, Lawrence Radiation Laboratory-Berkeley. Data are presented in three forms: conventional wind roses; the tabulation of the values used to prepare the roses; and as pseudo trajectories. Author

N71-29283# Environmental Science Services Administration, Norman, Okla. Research Labs.
TORNADO INCIDENCE MAPS
Arnold Court (San Fernando Valley State Coll.) Aug. 1970 80 p refs
(ESSA-ERLTM-NSSL-49) Avail: NTIS

Tornado occurrences in the United States have been tabulated and shown on maps since 1884, but very few of the 109 such maps, reproduced and discussed here, show actual tornado incidence per year per unit area; most are totals for periods of 6 to 62 years, by states, or by latitude-longitude quadrangles of varying areas. In the past century, the apparent center of maximum tornado incidence has moved southwestward, from western Illinois to Iowa and Missouri, to Kansas, and now to central Oklahoma, where the annual incidence per 10,000 square miles is 3 to 21 tornadoes, depending on the period for which reports are used. Proliferation of official tabulations, by states and quadrangles and for varying periods, has obfuscated the pattern of tornado occurrence, and failure to tabulate and map the actual damage areas has precluded a clear depiction of actual tornado hazard. To eliminate confusion, tabulations and damage area maps by 5-year and 10-year periods beginning in 1956 are recommended. Author

N71-29377# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 89, NO. 2: AIR POLLUTION DISTRIBUTION OVER GERMANY ESTIMATED FROM VISIBILITY OBSERVATIONS [METEOROLOGISCHE ABHANDLUNGEN. BAND 89, HEFT 2: VERSUCH EINER ABSCHAETZUNG DER VERTEILUNG DER LUFTVERUNREINIGUNG IN DEUTSCHLAND AUS SICHTWEITENBEOBACHTUNGEN]
Eleonore Mueller 1970 83 p refs In GERMAN; ENGLISH summary
Avail: NTIS

Visibility is used as a measurement factor correlated to air pollution by dust and aerosols, including observations under foggy conditions. Since the dust content of the air is inversely proportional to visibility it is considered that the degree of air pollution in Germany could be determined from estimates of horizontal visibility, except in fog conditions. The influence of disturbing factors, such as atmospheric moisture and lateral incidence of sunlight, is discussed. ESRO

N71-29382# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 103, NO. 1: WEATHER SATELLITE OBSERVATIONS AND THEIR EVALUATION. EUROPEAN CLIMATOLOGY 1969 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 103, HEFT 1: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD 1969. TEIL 1, 1. VIERTELJAHR]
Matthias Eckardt and Ingrid Haupt 1970 269 p refs In GERMAN; ENGLISH summary
(QR-1-Pt-1) Avail: NTIS

A short introduction on meteorological satellite observations including those from ESSA, Meteor, and ESRO satellites, is followed by European weather charts for the first quarter of 1969. They are evaluated with regard to the snow and ice cover. ESRO

N71-29384# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 111, NO. 2: THE MEANING OF ATMOSPHERIC ELECTRICITY IN THE METEOROLOGY [METEOROLOGISCHE ABHANDLUNGEN. BAND 111, HEFT 2: DIE BEDEUTUNG DER ATMOSPHAERISCHEN ELEKTRIZITAET IN DER METEOROLOGIE]
Horst Dietz 1970 83 p refs In GERMAN; ENGLISH summary
Avail: NTIS

The present state of knowledge on the relationships between atmospheric electricity and meteorological parameters is outlined. Ion production and the variation of atmospheric electricity parameters which are caused by variations in the ion concentration, are discussed. ESRO

N71-29401# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 255 28 Jun. 1971 p 9-22 (See N71-29399 17-34)
Avail: NTIS

News briefs and abstracts of scientific articles concerning meteorology are presented. Topics discussed include: 22 year cycle in meteorology, semidiurnal wind components in meteor zone, angular structure of earth's brightness field, microstructure of aerosols, absorption function for different gases, kinetics of droplet growth in radiation field, velocity of ascending currents in hurricanes, properties of ice forming substances, and triggering mechanism in thunderstorms. F.O.S.

N71-29424# California Univ., Wahiawa, Hawaii. Oahu Research Center.
THE PRACTICAL ASPECT OF TROPICAL METEOROLOGY, VOLUME 1
C. E. Palmer, C. W. Wise, L. J. Stempson, and G. H. Duncan Oct. 1970 225 p refs
(Contract AF 19(604)-546)
(AD-721687; AWS-TR-241-Vol-1; SR-2-Vol-1) Avail: NTIS CSCL 4/2

The report is in seven parts. After a short introduction, the manner in which the tropical forecaster may utilize climatological information is discussed. The next section emphasizes that the approach to the evaluation of tropical data is different from that which is standard in high latitude meteorology. Then follows a long discussion of wind analysis, using streamlines and isotachs. The fifth section covers methods of analyzing cloud and weather distribution; the methods outlined here are designed specifically for use in tropical regions. The sixth section deals with problems of correlation of wind and weather patterns, of continuity and with related topics; the material is presented chiefly in the form of practical examples. Finally, the structure, genesis and movement of tropical cyclones are briefly discussed. Author (GRA)

N71-29443# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
A COMPREHENSIVE REPORT ON NINETEEN CONDENSATION NUCLEI, PART 2 Research and Development Technical Report
Richard D. H. Low Jan. 1971 293 p refs
(AD-721591; ECOM-5358-Pt-2) Avail: NTIS CSCL 4/2

The document contains tabulations of the growth times of condensation nuclei under various assumed supersaturations.

The growth time of each nucleus at a given supersaturation is obtained from a newly developed growth rate equation which utilizes a single parameter to denote the hygroscopicity of the nucleus and which includes an additional term to reflect the inefficiency of the condensation process. This volume and its predecessor serve as a valuable reference for the experimental cloud physicist in his study of growth behaviors of condensation nuclei and for the field cloud physicist in his selection of the proper artificial nuclei for warm fog or cloud modification. Author (GRA)

N71-29474# California Univ., Los Angeles.
MARINE LAYER OVER SEA TEST RANGE Final Report
J. G. Edinger and M. G. Wurtele 15 Apr. 1971 96 p refs
(Contract N123(61756)56992A)
(AD-722398; PMR-TP-71-2) Avail: NTIS CSCL 4/2

The first section of the report presents a quantitative theoretical treatment of the southern California stratus problem and a suggested formulation of a forecast program. It points out the need for a systematic synoptic climatology of the local effects. The second section presents the results of an observational program conducted during the summer of 1966 that used an instrumented plane to provide a description of the offshore marine layer between Point Conception and Santa Catalina Island. It presents the distribution of the mean depth of the marine layer over this area and its diurnal variation. It also shows many of the disturbances induced by coastal and insular terrain. The third section presents the results of the observational program conducted in summer 1967 which covered more intensively the area offshore of the Santa Monica Mountains. It displays the average slope of the marine layer top in the verical section normal to the mountains, the average stability in the marine layer and the lower part of the inversion layer as a function of distance from the mountains including diurnal trends in these features. It also shows the average size of the small-scale bumpiness in the top of the marine layer. Author (GRA)

N71-29475# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
A BUOY SYSTEM FOR AIR-SEA INTERACTION STUDIES: BUOY DESIGN AND OPERATION
Erik Mollo-Christensen and Craig E. Dorman Apr. 1971 29 p
(Contract N00014-67-A-0204-0024; Grant NSF GA-23339)
(AD-722418; Rept-71-4) Avail: NTIS CSCL 13/10

The report describes a spar buoy built in 1969 and modified in 1970 on the basis of operational experience. The buoy was designed as an instrument platform for air-sea interaction measurements. Convenience of setting and of instrument replacement was an important design criterion, as was instrument exposure. The report describes the mechanical design of the buoy, its performance and some operational experience with the buoy. Author (GRA)

N71-29481 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
NUMERICAL EXPERIMENTATION RELATED TO GARP
B. R. Doscos Sep. 1970 32 p *Its* GARP Publ. No. 6 Copyright. Avail: Issuing Activity

The objectives and the scientific basis of the Global Atmospheric Research Program (GARP) are presented. Historical references to its origin and to the international mechanisms that have been established for its planning and implementation are given. After a discussion of the relation between explanation and prediction, the difficulties encountered in any attempt to define weather prediction in precise physical terms are shown. The current techniques based on physico-mathematical models of the atmosphere are then presented together with an analysis of the problems yet to be solved. Author (ESRO)

N71-29483 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
REPORT OF THE FIRST SESSION OF THE TROPICAL EXPERIMENT BOARD
Feb. 1971 83 p Conf. held at Geneva, 22–24 Feb. 1970 *Its* GARP Spec. Rept. No. 4
Copyright. Avail: Issuing Activity

A review of the report of the first session of the GARP Tropical Experiment Council is made followed by a presentation of the scientific plan for the experiment (GATE) which will focus on a study of the physical properties of cloud clusters over the tropical Atlantic. The experiment would be placed in the hands of a Scientific and Management Group and the organization, operation, and establishment of the Group is examined. A series of annexes gives information on synoptic features of atmospheric circulation, possible ship deployments for use in GATE cloud cluster statistics, and aircraft requirements. ESRO

N71-29484# Istituto di Fisica dell'Atmosfera, Rome (Italy).
THE ISTITUTO DI FISICA DELL'ATMOSFERA (IFA): THE METEOROLOGICAL TRAINING IN ITALY AND THE PROGRAM FOR THE MEDITERRANEAN METEOROLOGY
M. Giorgi Apr. 1970 10 p Presented at the WMO/IAMAP Symp. on Higher Educ. and Training, Rome, 27 Apr.–2 May 1970 Submitted for publication
(IFA-RDP-31) Avail: NTIS

The research activities of the Italian Institue of Atmospheric Physics (IFA) are reviewed and the lack of training facilities in meteorology elsewhere in Italy criticized. The experience gained by IFA has formed the basis of an Italian program to obtain a deeper knowledge of the meteorology and climatology of the Mediterranean and this is briefly described. ESRO

N71-29485 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
REPORT OF THE FIRST SESSION OF THE TROPICAL EXPERIMENT COUNCIL
Mar. 1971 34 p Conf. held at Geneva, 17–19 Feb. 1971 *Its* Spec. GARP Rept. No. 3
Copyright. Avail: Issuing Activity

This report of the first session of the GARP Tropical Experiment Council contains a review of the general plan for the GARP Atlantic Tropical Experiment (GATE) which aims at long-range weather prediction. The importance of the World Weather Watch network is considered and its possible contribution to GATE examined. National and regional activities resulting from the GATE program are studied as well as opportunities for special training and participation in GATE. ESRO

N71-29508# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ONE DIMENSIONAL QUASI TIME DEPENDENT NUMERICAL MODEL OF CUMULUS CLOUD ACTIVITY Research and Development Technical Report
Walter S. Nordquist, Jr. and Neil L. Johnson Dec. 1970 186 p refs
(AD-722216; ECOM-5360) Avail: NTIS CSCL 4/2

A numerical model for the description of some of the major features of isolated cumulus clouds formed as the result of surface heating is described. This one-dimensional model is an elaboration of the Weinstein and Davis Steady State Cumulus Dynamics model and has been extended to include a method for forecasting the environmental meteorological conditions. Detailed discussions concerning the development of the theory, the application of numerical techniques to the theory, and the computer calculation processes are provided. Author (GRA)

N71-29511# Weather Squadron (17th), Tinker AFB, Okla. Detachment 1.
TERMINAL FORECAST REFERENCE FILE, TINKER AFB, OKLAHOMA Final Report

Mar. 1971 92 p refs
(AD-722168) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting the Weather at Tinker AFB, Ok. Included are location and topography, weather controls, climatic aids, and local forecase studies. Author (GRA)

N71-29558# National Weather Service, Garden City, N.J.
THE AIRCRAFT RECONNAISSANCE, WEATHER SHIP AND BUOY PROGRAMS DURING EAST COAST STORMS OF THE 1969–1970 WINTER
Oct. 1970 23 p
Avail: NTIS

The East Coast storm reconnaissance program for 1969 to 1970 time period is discussed. Subjects presented are: (1) Air Force reconnaissance flights, (2) Navy reconnaissance flights, (3) ESSA reconnaissance flights, (4) case study of data obtained from reconnaissance flights, (5) importance of data obtained from ocean weather ships, and (6) conclusions and recommendations the concerning project. Author

N71-29689 National Lending Library for Science and Technology, Boston Spa (England).
PROBLEMS IN THE ANALYSIS OF THE INTERCONNECTION BETWEEN FRONTS AND THE TROPOPAUSE [VOPROSY ANALIZA VZAIMOSVYAZI FRONTOV S TROPOPAUZI]
I. N. Ponomarenko Mar. 1971 25 p refs Transl. into ENGLISH from Tr. Ukr. Nauch. Issled. Gidrometeorol. Inst. (Ukrainia), v. 56, 1966 p 3–17
(NLL-RTS-6362) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.40; 8 NLL photocopy coupons

A model of the interaction of tropospheric fronts with the tropopause based on analysis of 56 vertical sections of high fronts is discussed and improved. Methods of analyzing the boundaries of fronts and the tropopause in vertical sections are examined. The characteristics of frontal disturbance of a layer of the tropopause and the lower stratosphere are given. Author

N71-29747# New York Univ., N.Y. Geophysical Sciences Lab.
STUDIES OF ATMOSPHERIC WATER VAPOR AND HYDROMETEORS BY LASER RADAR Final Report
Richard M. Schotland, Albert Pace, Kenneth Sassen, and Richard Stone Feb. 1971 85 p refs
(Contract DI-14-06-D-6440)
(PB-197917; GSL-TR-71-4) Avail: NTIS CSCL 04B

A mode-controlled, electrically tuned, pulsed ruby laser radar system was developed to study the spatial distribution of atmospheric water vapor. Characteristics of the laser radar system, designed for field use, are given. The water vapor distribution is determined from observations of the spatial distribution of the atmospheric transmissivity when the system is tuned to the center of the 6943.8-angstrom water vapor line and then to the line wing. Examples are given of water vapor profiles obtained by laser radar at Rapid City, S. Dak. during the summer of 1970. A comparison of these profiles is made with those obtained from a radiosonde located at the Rapid City airport. Laboratory and field data are presented for depolarization ratios measured for water clouds and ice clouds, and an example is presented for a mixed layer cloud. The depolarization ratio is near zero for a pure water droplet cloud, but ice clouds have ratios of 0.4 to 0.8. The variation of the depolarization ratio with penetration into a mixed cloud is given. Large variations of the depolarization ratio were noted, suggesting that the cross section of ice to water varied with distance within the cloud. Author (GRA)

N71-30011# Air Force Cambridge Research Labs., Bedford, Mass.
PRELIMINARY MODELS FOR DETERMINING INSTANTANEOUS PRECIPITATION INTENSITIES FROM AVAILABLE CLIMATOLOGY
Robert W. Lenhard, Allen E. Cole, and Norman Sissenwine 5 Mar. 1971 22 p refs *Its* Environ. Res. Papers No. 350
(AD-722684; AFCRL-71-0168) Avail: NTIS CSCL 4/2

Preliminary models are developed relating 1-minute precipitation rates to commonly available monthly climatology. Regression equations are provided for precipitation rates equal or exceeded 0.1, 0.5, 1.0, and 2.0 percent of the time during a month. Models are developed using a precipitation index (monthly precipitation/number of days per month with precipitation) alone, and the index and monthly mean temperature as estimators. Separate models are presented for tropical and extratropical regimes, with some gain in precision of estimate offset by loss of confidence due to the small amount of data and fewer locations in each subset. The models and regressions are regarded as preliminary, since only 36 months of data are available for four stations. Data for additional stations are being prepared and will be used to refine these models. Author (GRA)

N71-30054# Army Electronics Command, Fort Monmouth, N.J.
REDUCED CEILINGS AND VISIBILITIES IN KOREA AND SOUTHEAST ASIA
Joseph R. Levine Mar. 1971 50 p refs
(AD-722735; ECOM-3403) Avail: NTIS CSCL 4/2

The report summarizes frequency of occurrence of poor ceiling and visibility conditions in Southeast Asia and Korea. The minimum ceilings considered are 1000 feet in Southeast Asia and 300 feet in Korea. Visibility criteria are less than 2.5 miles in Southeast Asia and 1.75 miles in Korea. In general, the greatest frequencies of occurrence are found in early morning hours, and they decrease greatly by afternoon. Much of this dependency of the frequency can be attributed to geographical location, notably the proximity to bodies of water. Some seasonal dependency is also noted in the Southeast Asian land mass due to the effects of monsoon activity. Author

N71-30071*# Stanford Research Inst., Menlo Park, Calif.
AN INVESTIGATION OF MOUNTAIN WAVE TURBULENCE WITH LIDAR OBSERVATIONS Final Report
William Viezee Apr. 1971 78 p refs
(Contract NAS1-9951; SRI Proj. 8573)
(NASA-CR-111916) Avail: NTIS CSCL 04A

In March and April of 1969 and 1970, lidar (laser radar) observations of the atmospheric structure were made in the lee of the Sierra Nevada during the occurrence of mountain lee waves. Rawinsonde ascents and, in some occasions, research-aircraft flights supported the lidar observations. The objective of the program was to explore the applicability of the lidar technique to atmospheric turbulence detection. The observations demonstrate that the lidar can delineate significant features of the atmospheric-flow pattern by monitoring echoes from concentrations of particulate matter that characterize the airflow structure in the form of either visible or subvisible clouds and dust. For example, the lidar describes in remarkable detail the development, spatial distribution, and optical characteristics of the lenticular clouds that identify the tropospheric layer of major wave motion and the formation and location of rotor clouds, which identify the lower turbulence zone. By monitoring in space and time the echoes that arise from the presence of the rotor clouds and from the presence of dust and variable dust concentrations within the boundary layer, the lidar can detect the vertical extent and the temporal variations of the lower turbulence zone (the Turbulent Boundary Layer under the lenticular clouds), which can harbor moderate and severe turbulence associated with convection and rotor flow. Author

N71-30257# Weather Squadron (24th), Detachment 15, Vance AFB, Okla.
TERMINAL FORECAST REFERENCE FILE, VANCE AFB, OKLAHOMA, CHANGE 1 Final Report
16 Apr. 1971 19 p
(AD-722397) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting the weather at Vance AFB, Oklahoma. Included are location and topography, weather controls, climatic aids, and special synoptic studies. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-29370# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Mechanik und Bewegungssimulation.

A SURVEY OF UNCONVENTIONAL GYROS [EINE UEBERSICHT UEBER DIE NICHTKONVENTIONELLEN KREISELGERAETE]

Juergen Puls Feb. 1970 25 p refs In GERMAN; ENGLISH summary

(DLR-MITT-71-02) Avail: NTIS; DFVLR Porz: 7,80 DM

A survey of the unconventional gyros known presently is given. The reasons for the investigation of these types are presented. More emphasis is placed on the description of physical principles rather than on technical details. Author (ESRO)

N71-29371# Dansk Industrisyndikat A/S, Herle.

A COMPARATIVE STUDY OF AN AUTOMATIC BALANCING SYSTEM FOR A THREE-AXIS SATELLITE MOTION SIMULATOR

C. G. Rasmussen Paris ESRO Jul. 1970 81 p refs

(Contract ESTEC-750/69-AA)

(ESRO-CR-18) Avail: NTIS

The conditions of three-axis balancing are analyzed for different attitudes of the platform. Estimates of the required accuracy and time of measurement are derived on a basis of a mathematical analysis of different basic principles for the determination of unbalance. The analysis covers principles based on repeated balancing in two fixed platform positions as well as those assuming free motion of the platform. A number of proposals are presented of an automatic three-axis balancing system and the feasibility of the proposed systems. Special attention is devoted to force-balance, impulse-balance, and free motion sampled-data systems. Possible disturbing effects are reviewed and a proposal of an automatic compensator for the effect of variable compliance of the platform is analyzed. Author (ESRO)

N71-29504# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INERTIAL GUIDANCE OF BALLISTIC MISSILES

A. Yu. Ishlinskii 8 Jan. 1971 129 p refs Transl. into ENGLISH of the book 'Inertsialnoye Upravleniye Ballisticheskimi Raketami: Nekotoryye Teoreticheskiye Voprosy' Moscow, Izd-Vo Nauka, 1968 p 1-142

(AD-722291; FTD-MT-24-291-70) Avail: NTIS CSCL 17/7

This monograph discusses the mathematical principles of certain allowed variants of inertial guidance of the flight of ballistic missiles, i.e., control without the use of any external information (radio signals, radiation of stars and others). It is assumed that the providing of the assigned flight range of the missile is produced as a result of the well-timed switching-off of its engine by a signal entering from the computer. Fed into the input of the latter are readings of sensitive elements of the system of inertial guidance, and these measure the apparent acceleration of the missile or integrals from the apparent time acceleration. Control should be such that the deviation of the actual motion of the missile from the rates does not have an effect on the range of its flight. To accomplish this, measuring instruments are placed on the missile in a quite definite manner, and, in particular, the direction of their axes of sensitivity in a number of cases is stabilized by means of gyroscopes. Author (GRA)

N71-29700 Wisconsin Univ., Madison

DYNAMIC STABILITY OF A SATELLITE WITH AN ELASTIC MEMBRANE

Donald Paul Brown (Ph.D. Thesis) 1969 98 p

Avail: Univ. Microfilms Order No. 70-3487

A mathematical model representative of a satellite with continuous elastic components is defined as consisting of a moment free rigid carrier to which is attached an elastic membrane. The membrane is oriented such that a centroidal principal axis of the rigid carrier is normal to the undeflected membrane and passes through the membrane center of mass. The system is considered to be conservative. The rotational and membrane vibratory equations of motion are developed using both Newton's Second Law and an energy approach. It is recognized from the resulting coupled nonlinear set of equations that an equilibrium motion of the system consists of a nominal spin about the centroidal principal axis normal to the undeflected membrane. It is this steady rotation whose stability is studied, where both a linear and non-linear stability analysis is made. Dissert. Abstr.

N71-30070# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

WEAPON SYSTEMS. POLARIS SUPPORT Quarterly Report, Oct.-Dec. 1970

Dec. 1970 11 p

(Contract N00017-62-C-0804)

(AD-722485; APL-WQR-170-4B) Avail: NTIS CSCL 17/7

This report reviews the work of the applied Physics Laboratory in support of the Polaris program for the period 1 October through 31 December 1970. In this volume results are reported on updating of the Mk 3 Mod 0 dignostic program for the AN/BRN-3 satellite navigation set. Author (GRA)

N71-30179# Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).

PRESENT DAY DEVELOPMENTS ON BEHALF OF SEA TRANSPORT, AIR TRANSPORT, AND METEOROLOGICAL PREDICTION REQUIREMENTS Report on Omega, Feb. 1967-Jan. 1971

H. J. Bos, comp. Mar. 1971 26 p refs

(TDCK-56921; Rept-4) Avail: NTIS

The principle of Omega is based on the measurement of the phase difference between two low frequency signals relayed phase-synchronized by two separate transmitters. Shipboard performance tests with two Omega receivers provided a continuous position with an internal accuracy of about 1.5 n.mi. and with a systematical error in relation to the true position of maximum 5 n.mi. Author

N71-30253# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

AIRBORNE TRANSPONDERS, (IFF AND/OR AIR TRAFFIC CONTROL) Final Report

19 Mar. 1971 19 p refs

(AD-723028; MTP-6-3-126) Avail: NTIS CSCL 17/2

The materiel test procedure describes tests for evaluating airborne transponders operated in conjunction with air traffic control facilities. Tests are conducted by aircraft equipped with the airborne transponder and designated auxiliary equipment, directed and controlled by an air traffic control facility suitably equipped with compatible interrogating equipment and auxiliary equipment. Author (GRA)

N71-30315# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences Section.
A STATISTICAL ANALYSIS OF THE A-6A INERTIAL NAVIGATION SYSTEM
R. Gran Jun. 1971 21 p refs
(RM-511) Avail: NTIS

A statistical analysis of the gyro-compass mode of the A-6A inertial navigation system was performed. The inertial system is assumed to have various stochastic perturbations caused by gyroscope drifts, accelerometer drift, and a white measurement noise from the ship inertial navigation system (SINS). The result of the analysis is the variance in the estimate of the gyroscopic drift due to the assumed stochastic processes. The analysis of the system as provided by the ground support department showed that the system was unstable as it stood. A change in one of the feedback gains was made so as to stabilize the gyro-compass loop. Then, an analysis of the resulting loop showed a maximum error of 9.9 deg/hr due to all of the assumed noises. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-29206# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM TECHNOLOGY DEVELOPMENT PROGRAM. MASS TRANSFER INVESTIGATIONS IN LIQUID METAL SYSTEMS Quarterly Progress Report, Sep. – Nov. 1970
Dec. 1970 39 p refs
(Contract AT(04-3)-189)
(GEAP-13539-15; QPR-15) Avail: NTIS

Corrosion of candidate structural materials, the influence of corrosion and of impurities in the sodium on engineering properties of materials, and corrosion and deposition of radioactive isotopes from the core cladding are being studied in test loops designed to simulate typical conditions of sodium-cooled reactors. Current work is directed to the near term requirements for data and the development of sodium technology for application to FFTF and LMFBR demonstration plant designs. Emphasis is placed on deposition studies, design data for materials performance, the associated requirements and methods for plant chemistry control, and data on the transport and buildup of radioactive isotopes. Author (NSA)

N71-29207# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM TECHNOLOGY DEVELOPMENT PROGRAM. MASS TRANSFER INVESTIGATIONS IN LIQUID METAL SYSTEMS Quarterly Progress Report, Jun. – Aug. 1970
Sep. 1970 31 p refs
(Contract AT(04-3)-189)
(GEAP-13539-14; QPR-14) Avail: NTIS

Activities in a program to test corrosion properties of candidate materials for use in large sodium cooled reactors are summarized. Current work is directed to the near term data or development requirements of sodium technology for application to FFTF and LMFBR demonstration plant designs. Results of research are included on mass transfer, monitoring of sodium systems, and corrosion of stainless steel. NSA

N71-29208# California Univ., Berkeley. Lawrence Radiation Lab.
DECAY STUDIES OF NEUTRON DEFICIENT ISOTOPES OF ASTATINE, POLONIUM, AND BISMUTH
Janis M. Dairiki (Ph.D. Thesis) Nov. 1970 159 p refs
(Contract W-7405-eng-48)
(UCRL-20412) Avail: NTIS

Alpha particle and gamma ray studies were made of the decay of neutron-deficient isotopes of astatine, polonium, and bismuth. Astatine isotopes were produced in Au reactions; polonium and bismuth sources were obtained as products of astatine decay. Three kinds of experiments were performed: measurements of alpha particle energies and branching ratios, high resolution gamma ray singles studies, and gamma gamma coincidence measurements. In the gamma ray studies measurements were made on a source containing a mixture of isotopes with no previous chemical separation, primarily due to the short half lives involved. Computer codes were developed to analyze the resulting complex multicomponent gamma spectra. Author (NSA)

N71-29209# WADCO Corp., Richland, Wash. Hanford Engineering Development Lab.
ANALYSIS OF ZPPR/FTR SHIELD EXPERIMENTS: GAMMA DISTRIBUTION
E. T. Boulette and W. L. Bunch Feb. 1971 48 p refs
(Contract AT(45-1)-2170)
(WHAN-FR-13) Avail: NTIS

The coupling of one dimensional transport theory with two dimensional diffusion theory is shown to be a practical method for realistically predicting measured gamma flux distributions throughout the core, reflectors, shield, and stored fuel zone of assembly FTR-2 in the Zero Power Plutonium Reactor (ZPPR). Two dimensional diffusion theory calculations were used to generate the neutron flux distribution upon which the volumetric gamma source was based. It is also demonstrated that gamma yields for thermal neutron capture will realistically predict the gamma flux distribution in a fast reactor environment, such as the FTR. Author (NSA)

N71-29222# Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari.
SURVEY OF ADVANCEMENTS IN NEUTRON STATISTICS AND REACTOR KINETICS TECHNIQUES AT LFCR (1967 1969)
N. Pacilio 1970 35 p refs
(RT/FI-(70)29) Avail: AEC Depository Libraries

Part of the work was realized in cooperation with Argonne National Laboratory, Battelle Memorial Institute Pacific Northwest Laboratory and the United States Atomic Energy Commission, U.S.A. A comprehensive bibliography is given for specific details on the single sections of the survey. Author (NSA)

N71-29223# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
IRRADIATION EXPERIMENTS ON CYRANUM CAPSULES FOR THE STUDY OF THE THERMAL BEHAVIOR OF FUEL RODS. RESULTS ON SAMPLES OF UO2 IN PELLETS [ESPERIENZE D'IRRAGGIAMENTO DI CAPSULE CYRANUM PER LO STUDIO DEL COMPORTAMENTO TERMICO DELLA BARRETTA COMBUSTIBILE. RISULTATI DEI CAMPIONI AD UO2 IN PELLETS]
A. Calza Bini, G. Cosoli, G. Filacchioni, M. Lanchi, A. Nobili et al
9 Jul. 1970 85 p refs In ITALIAN
(RT/ING-(70)15) Avail: AEC Depository Libraries

The purpose of these experiments was to study the thermal properties of ceramic fuel UO2 and UO2-PuO2 rods, consisting of pellets and vibrocompacted powder. The results of the irradiations of the two first capsules containing pelleted UO2, in RS-1 Avogadro Reactor at Saluggia, are reported. Author (NSA)

N71-29224# Australian Atomic Energy Commission, Coogee.
[ACTIVITIES OF THE AAEC IN THE FIELDS OF RAW MATERIALS, RESEARCH RELATED TO NUCLEAR POWER,

RADIATION AND RADIOISOTOPE RESEARCH, PRODUCTION AND DISTRIBUTION, AND OPERATIONS AND SERVICES] Annual Report, 1969–1970
1970 22 p refs
(NP-18726; AR-18) Avail: AEC Depository Libraries

An account is given of the activities of the A.A.E.C. in the fields of raw materials (the Rum Jungle enterprise, exploration for, and production of uranium); research related to nuclear power including reactor materials, fuels, water cooling, and criticality studies; radiation research and radioisotope research, production and distribution; operations and services; and various administrative matters including international cooperation. NSA

N71-29231# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report, Aug.–Oct. 1970
R. V. Carlson, comp. Jan. 1971 46 p refs
(Contract AT(30-1)-3714)
(BAW-3714-19; QPR-17) Avail: NTIS

The development of a sol-gel process and related processes for preparing (U,Pu)O2 fast reactor fuels has continued. Eighteen fuel pins containing U-235O2-20% PuO2 in the form of pellets, shards, or sol-gel microspheres have passed final inspection for an unencapsulated bundle to be irradiated in the EBR-2. Sufficient coprecipitated powder and sol-gel microspheres for the EBR-2 reload pins were prepared. Pellets and shards are being fabricated. Nine capsules irradiated in the reactor were disassembled previously. Gas analyses and detailed metallographic examinations of the 27 fuel pins contained in these capsules are in progress in hot cell facilities. Author (NSA)

N71-29238*# Translation Consultants, Ltd., Arlington, Va.
REPORT ON THE RESEARCH ON THE ITR PROJECT [BERICHT UEBER ARBEITEN ZUM ITR-PROJEKT]
K. H. Hoecker Washington NASA Jun. 1971 48 p refs Transl. into ENGLISH of Stuttgart Univ., Inst. of At. Energy report K-19, Jan. 1971
(Contract NASw-2038)
(NASA-TT-F-13685; K-19) Avail: NTIS CSCL 18I

The report discusses some mathematical aspects of neutron physics. Screening the unit and the time behavior of the ITR system are also treated. The concluding sections of the report deal with thermionics, thermodynamics and energy transport. Author

N71-29251*# Translation Consultants, Ltd., Arlington, Va.
CALCULATION OF TEMPERATURE DISTRIBUTION IN AN INCORE THERMIONIC REACTOR [BERECHNUNG DER TEMPERATURVERTEILUNG IN EINER INCORE-THERMIONIKZELLE]
L. Ehnis et al Washington NASA Jun. 1971 53 p refs Transl. into ENGLISH of Stuttgart Univ., Inst. for Nucl. Energy, report, Rept-5-111
(Contract NASw-2038)
(NASA-TT-F-13686; Rept-5-111) Avail: NTIS CSCL 18I

The temperature distribution of the emitter fuel system of an incore thermionic reactor is calculated in two dimensional (r, z) and (r, phi) geometry. The heat conduction equation is solved by a difference method. The thermionic cell is represented by a simplified geometrical model. The cavity in the fuel formed during operation (fuel pipe effect) is not exactly calculated but only estimated for the calculation of the temperature distribution. The converter boundary conditions are calculated by means of the computer program SIMCON for two operation points (emitter heat flux densities of 40 W/sq cm and 70 W/sq cm). The heat flux densities are used in linearized form in the difference method. Author

N71-29292# Oak Ridge National Lab., Tenn.
HIGH TEMPERATURE BURST STRENGTH AND DUCTILITY OF ZIRCALOY TUBING
R. D. Waddell, Jr. and P. L. Rittenhouse Mar. 1971 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3289) Avail: NTIS

Isothermal tube burst tests were performed to determine the strength, ductility, and failure mode of Zircaloy-4 fuel rod cladding in the temperature range 1100 to 2100 F. Tests were conducted on Zircaloy tubing into which controlled wall defects were introduced as well as on stress-relieved material containing no wall defects. The defects were designed to simulate those that might be formed during loading of a reactor core or as a result of corrosion. At all test temperatures, the undefected material showed circumferential strains in excess of 50%. The presence of wall defects did not affect rupture stress but did, depending on the type of defect, influence rupture location as well as magnitude of the expansion. Author (NSA)

N71-29293# Oak Ridge National Lab., Tenn.
ADDITIONAL EXPERIMENTS ON ELECTROLESS NICKEL COATINGS FOR HIGH PERFORMANCE ALUMINUM FUEL PLATES
J. C. Griess, R. D. Cheverton, and J. R. McGuffey Mar. 1971 19 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3297) Avail: NTIS

Electroless nickel coatings on aluminum were investigated using electrically heated water-cooled specimens in an out-reactor flow loop, and also using nickel-coated fuel plates in-reactor. The out-reactor experiments indicated that the as plated coatings had sufficient ductility and adherence to withstand higher temperatures, temperature gradients, and coolant velocities than encountered in present-day high performance research reactors. The in-reactor experiments, however, resulted in essentially complete loss of the nickel coating in a brief period of time. Possible mechanisms for in-reactor loss have been suggested. It is possible that operation with pure water (pH approximately equal to 7) and hydrogen addition would preserve the integrity of the nickel coating. It is recommended that such an experiment be conducted. Author (NSA)

N71-29294# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Fuel Div.
SAXTON PLUTONIUM PROJECT Quarterly Progress Report, Period Ending 31 Dec. 1970
T. E. Caye and W. R. Smalley Mar. 1970 20 p refs
(Contract AT(30-1)-3385)
(WCAP-3385-26) Avail: NTIS

Information was developed concerning the utilization of plutonium enriched fuel in pressurized water reactor systems. The program includes design, fabrication, operation, and post-irradiation examination of a partial plutonium core. Author

N71-29295# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
DULCINEE CODE [CODE DULCINEE]
Pierre Dutraive, Samuel Fabrega, and Francoise Millot Nov. 1970 69 p In FRENCH
(CEA-N-1378) Avail: AEC Depository Libraries

The DULCINEE code is elaborated in order to study the behavior of a water cooled reactor at low pressure, either in steady state conditions or in transient ones during a reactivity accident or a loss of coolant accident. Author (NSA)

N71-29366# Rensselaer Polytechnic Inst., Troy, N.Y.
STANDARD CENTRAL COMPILATION OF THE RESULTS FOR INTEGRAL TESTS OF MICROSCOPIC DATA

B. K. Malaviya and E. R. Gaerttner [1970] 5 p refs
(Contract AT(30-1)-328)
(RPI-328-219) Avail: NTIS

The continuing accumulation of the results of integral tests of differential cross section data from a variety of sources has raised the question of an appropriate mechanism for the presentation and systematic compilation of these results so as to channel the information to reactor design and data evaluation groups in a readily available and directly usable form. A proposed format for such a compilation is developed to bring together in a systematic, compact form the upcoming results of integral measurements and analyses of importance to fast reactor analysis and development. The compilation format incorporates all the relevant details of the measurement and calculation and should considerably facilitate rapid and fruitful exchange of information relating to the evaluation of cross section data based on integral studies. Author (NSA)

N71-29367# Oak Ridge National Lab., Tenn.
COMPUTER PROGRAMS FOR MSBR HEAT EXCHANGERS
C. E. Bettis, W. K. Crowley, H. A. Nelms, T. W. Pickel, M. Siman-Tov et al Apr. 1971 158 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2815) Avail: NTIS

Three computer programs were developed to make design calculations for the heat exchangers for Molten-Salt Breeder Reactor concepts. They are the program for the primary heat exchangers, PRIMEX; the program for the reheaters, RETEX; and the program for the steam generator superheaters, SUPEX. Each type of exchanger analyzed is described, the basic equations used in each analysis are given, and the logic used in each program is discussed briefly in this report. Flow diagrams, lists of input required and output received, complete program listings, and the nomenclature for the programs as well as example computer input and output for the exchangers described are appended. Author (NSA)

N71-29368# General Electric Co., San Jose, Calif. Reactor Fuels and Reprocessing Dept.
ZIRCALOY CLAD UO2 FUEL ROD EVALUATION PROGRAM Quarterly Progress Report, Aug. – Oct. 1970
F. H. Megerth, comp. Nov. 1970 48 p refs
(Contract AT(04-3)-189)
(GEAP-10287; QPR-12) Avail: NTIS

Diameter profiles were obtained on four fuel rods as a means of further investigating certain areas that were believed to possibly be defective. The profiles of three rods revealed no evidence of defects. The fourth rod did show two peaks of uncertain causes up to 0.0064 cm on the diameter. Length measurements made on 12 rods indicated increases over the pre-irradiation lengths of 0.15 to 0.33 cm. The free gas contained in selected fuel rods was analyzed for fission gas release and composition. The compositions of the gas samples appeared quite normal. The cladding and fuel of several transverse fuel rod sections were examined metallographically. The thickness of the ZrO2 layer varied considerably around the circumference of some specimens. The UO2 of three specimens was examined in the as-polished and etched conditions, and evidence of equiaxed central grain growth was observed in two of them. Author (NSA)

N71-29381# Institutt for Atomenergi, Halden (Norway).
IRRADIATION BEHAVIOUR AND POST-IRRADIATION EXAMINATION OF SWEDISH TEST FUEL ASSEMBLY IFA-30
S. Junkrans, T. Olsson, and K. D. Knudsen Sep. 1970 24 p refs
(HPR-127) Avail: AEC Depository Libraries

Post-irradiation examination was performed on the nine fuel rods of test fuel assembly IFA-30 (S) which was irradiated in the Halden Boiling Heavy Water Reactor (HBWR) to an average burnup of 5800 MWd/t U. The fuel rods were made of Zircaloy-2 cladding containing sintered UO2 pellets enriched to 5 w/o U-235 of total uranium. The performance of the assembly was very satisfactory thereby confirming the suitability of the design and fabrication methods. Author (NSA)

N71-29501# Reactor Centrum Nederland, Petten.
IN AND OUT OF PILE EXPERIMENTS RELATED TO THE SAFETY OF FAST REACTOR FUEL PINS
A. van der Linde and H. Kwast Dec. 1970 53 p
(EURFNR-884; RCN-133) Avail: AEC Depository Libraries

The R.C.N. work related to safety aspects of fast reactor fuel pins is comprised of fuel pin performance tests, clad failure experiments, and fuel pin loss of cooling experiments. The clad failure experiments are performed on fuel pins, irradiated at relatively severe operating conditions, and on cladding tube sections pressurized out of pile up to failure. After a description of possible mechanisms and consequences of a fuel pin failure, the fuel pin and cladding test equipment and the intended experiments on the above mentioned subjects are described. Some preliminary results of completed introductory experiments are presented. Author (NSA)

N71-29505# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
THEORETICAL ANALYSIS OF A METHOD OF SIMULATION WITHOUT A PILE OF THE THERMAL GRADIENT OF A ROD IN A REACTOR [ANALISI TEORICO SPERIMENTALE DI UN METODO PER LA SIMULAZIONE FUORI PILA DEL GRADIENTE TERMICO DI UNA BARRETTA IN REATTORE]
C. Cesaroni 30 May 1970 56 p refs In ITALIAN
(RT/ING-(70)11) Avail: AEC Depository Libraries

Induction heating was used in order to study thermal and mechanical fuel behavior in-pile simulating the parabolic temperature distribution of a fuel rod. The purpose was to find the radial temperature distribution corresponding to the maximum temperature zone of a UO2 pellet. The influence of the various parameters on temperature distribution was also examined. An analogic method is defined which takes into account the nonlinear aspect of the problem and allows a parametric study based on the assumption that the conditions are stationary. The experimental tests confirming the results obtained are reported. Author (NSA)

N71-29509# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
STUDIES OF FISSION-GAS DISENGAGEMENT AND TRANSPORT PHENOMENA FOR FFTF FUEL-FAILURE DETECTION
E. S. Sowa, F. Verber, and G. T. Goldfuss Jan. 1971 55 p refs
(Contract W-31-109-eng-38)
(ANL-7774) Avail: NTIS

Fission-gas injections into flowing and stagnant sodium were followed by measurement of the dynamic disengagement behavior of the upper gas blanket regions located at the top of the loop. The studies were divided into five phases: water mockup injection of radiokrypton to observe expected behavior of riser flow systems; initial experiments with gas injections into sodium flowing at 10 fps with temperature at 1000 and 1100 F, respectively; injections into sodium flowing at 7, 5, 3, and 2 fps with temperatures of 500 and 1000 F; tests with the upper riser replaced with the prototype FEDAL module; tests of Xe(133) injections into sodium flowing at 0, 2, 4, and 8 fps with temperatures at 500 and 1000 F and with the FEDAL module on the loop. The results showed that hydrodynamic theory was confirmed and that the bulk of the gas separation occurred approximately 1.5 min after injection for a lineal sodium flow rate of 10 and 7 fps in the injection zone. Flooded level operation was more effective than with the internal cascade, recovery time being within 48 secs. The behavior of Xe(133) was found to be identical to that of Kr(85). Author (NSA)

N71-29510# United Kingdom Atomic Energy Authority, Dounreay (Scotland). Reactor Group.
NEUTRON SPECTRA FOR RUN 59/1 OF THE DOUNREAY FAST REACTOR
D. S. Crowe Dec. 1970 34 p refs
(TRG-Report-2118) Avail: AEC Depository Libraries; HMSO 25d

Tabulated total and group fluxes were calculated for the reactor loading as it was for Sectors B to F in Run 59/1. These results may be used for similar reactor loadings since Run 59/1 but should not be used for Sector A which has five rows of nickel instead of the normal three rows in the reflector. Author (NSA)

N71-29515# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Feb. 1971
22 Mar. 1971 113 p refs
(Contract W-31-109-eng-38)
(ANL-7783) Avail: NTIS

Highlights of project activities for February 1971 are summarized. LMFBR physics development and component development are reviewed. Operations and analysis of ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects are summarized. Reactor fuels and materials development, engineering development, fuel cycle chemistry, and LMFBR safety studies are reported. NSA

N71-29526# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
RAPSODIE FIRST CORE FABRICATION [FABRICATION DU PREMIER COEUR DE RAPSODIE]
Yves Masselot, Simone Bataller, Michel Ganivet, Henri Guillet, Andre Robillard et al Jun. 1970 77 p refs In FRENCH
(CEA-R-3501(2); EUR-3862(2)) Avail: AEC Depository Libraries

A description is given of the processes, results, and particular technical problems related to the manufacture of the first neutron pile core of the fast reactor Rapsodie. A critical study was made of the results obtained on the pellets, pins, and subassemblies in relation to their specifications. The advantage of the linear mass concept as a quality test for a given manufacturing process is shown. The performances obtained during the first two production runs are examined. Author (NSA)

N71-29527# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares.
CORRELATION METHODS IN THE STUDY OF NUCLEAR REACTOR
Jaime M. Costa Oliveira 1970 27 p refs In PORTUGUESE Presented at the Symp. on Theory of Inform. and of Systems, Lisbon
(LFEN-NI-58-a; CONF-700943-1) Avail: AEC Depository Libraries

A method for the study of the transfer function of a nuclear reactor, based on the intercorrelation of the responses of two neutron detectors, is described. The signals are subjected to a surface diagram and the results are fed to a computer together with a program for the calculation of the correlation function and the spectral density of interaction. The advantages of the variation of the intercorrelation method adopted is shown. Author (NSA)

N71-29528# Gosuderstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
THEORY OF THE CRITICALITY OF A REACTOR DURING OSCILLATIONS OF THE FUEL DENSITY (AN ADIABATIC APPROXIMATION)
V. M. Novikov 1970 24 p refs In RUSSIAN
(IAE-1964) Avail: AEC Depository Libraries

In one-group approximation an adiabatical theory is presented for calculation of the additional reactor reactivity appearing when the gaseous fuel density oscillations are excited. It is shown that in case of the ratio of the relative oscillations amplitude to (K sub infinity)− 1 much smaller than 1, the magnitude of the criticality appears as a second order effect with the relative oscillations amplitude; on the other hand, when the ratio is much greater than 1, the magnitude of (Delta K sub eff) is directly proportional to the amplitude. The dependence of the (Delta K sub eff) on oscillations frequency is obtained for the case where the ratio is much less than 1. The dependance of (Delta K sub eff) on sound velocity in fuel and on the number of oscillations half-waves keeping within reactor size is analyzed. The experimental possibility of modelling these effects by means of surface gravitational waves excitation in liquid fuel in reactor horizontal canals is discussed. Author (NSA)

N71-29550# Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.
STATUS OF THE PHYSICS OF FAST REACTORS
R. S. Singh and B. P. Rastogi 1970 16 p refs
(BARC/I-58) Avail: AEC Depository Libraries

A survey is made of the status of the physics of fast reactors. The main areas of physics development are broadly divided into five groups, namely, nuclear data, theory and computational methods, integral experiments and analysis, reactivity coefficients, and performance studies and fuel cycles. The overall aim is to predict the various design parameters of a reactor such as criticality, power production, breeding or conversion, reactivity effects, dynamic characteristics, control rod worths, and performance of shields, as accurately as possible. A coordinated effort among the five disciplines mentioned above is made to achieve the objectives. The individual problems to be tackled in these areas were discussed. NSA

N71-29628# Aktiebolaget Atomenergi, Stockholm (Sweden).
IN-PILE DETERMINATION OF THE THERMAL CONDUCTIVITY OF UO2 IN THE RANGE 500 TO 2500 DEGREES CENTIGRADE
Jan-Ake Gyllander Jan. 1971 71 p refs
(AE-411) Avail: AEC Depository Libraries

The thermal conductivity of stoichiometric UO2 with a sintered density of 10.57 g/cc was determined. The irradiation was performed in the gas-cooled loop of the R2 reactor. The irradiation rig was moved in a vertical direction thus varying the neutron flux and hence the power output. The cooling gas was helium except for a short period at the end of the experiment when the gas was changed to argon. The instrumentation consisted of 5 thermocouples for temperature measurements and 4 beta-current detectors for continuous relative power measurement. Pure cobalt wires as melting and neutron dose monitors were also inserted into the fuel. The thermal conductivity of UO2 was found to be 1/(6.4 + 0.0227 × T) + (0.5 × 10 to the minus 12th power) × (T cubed)W/(cm × K) with T in degrees Kelvin. Author (NSA)

N71-29685# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
FAILED FUEL PERFORMANCE IN NATURALLY CONVECTING LIQUID METAL COOLANT
K. E. Gregoire, P. E. Novak, and R. E. Murata Jun. 1970 46 p refs
(Contract AT(04-3)-189)
(GEAP-13620) Avail: NTIS

The results of an experiment are described in which two fuel specimens containing mixed oxide (Pu0.25U0.75)O2.0 were irradiated in NaK cooled natural circulation capsules in the test reactor at power and temperature conditions in excess of those expected in current LMFBR designs. Both of the specimens failed at < or − 18,000 MWd/Te. One of the specimens was immediately removed from the reactor after failure while the other was permitted to continue irradiation to 53,000 MWd/Te. Observation of both failed fuel pins showed significant transverse dimensional changes and fuel-cladding reaction. Author (NSA)

N71-29866# Argonne National Lab., Ill. Reactor Analysis and Safety Div.

STUDY OF COOLANT TRANSIENTS DURING A RAPID FISSION-GAS RELEASE IN A FAST-REACTOR SUBASSEMBLY

T. C. Chawla and B. M. Hoglund Jan. 1971 41 p refs (Contract W-31-109-eng-38) (ANL-7651) Avail: NTIS

The mathematical model developed was used to consider a multiple pin failure in a fast reactor subassembly. It was assumed that the released gas filled the subassembly cross section uniformly and that the coolant flow was incompressible. The inertial contribution of the liquid columns beyond the pin assembly, as well as the three-dimensional flow effects in the inlet and outlet plenums, were considered. In the application of the model to out-of-pile simulation loops or in-pile test loops, points of departure in hydraulic simulation of the actual reactor conditions can be taken into account. A quantitative criterion for valid application of the model was obtained in terms of breach size, number of pins ruptured, intial gas-plenum pressure and temperature, and subassembly operating conditions. The predictions of the flow transients obtained by means of the model agreed well with the experimental data. An example of the application of the model to a reactor configuration was given using a fast flux test fuel subassembly. Author (NSA)

N71-29858# Oak Ridge National Lab., Tenn.

IODINE BEHAVIOR AND CONTROL IN PROCESSING PLANTS FOR FAST REACTOR FUELS

O. O. Yarbro, D. J. Crouse, and G. I. Cathers *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 551-567 refs Sponsored by AEC (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

The Pu content and resulting high specific value of fast reactor fuels make it economically desirable to process after as little as 30 days' decay. This reduced decay time requires plant retention factors for I approaching 10 to the 8th power, and will place demands on the I removal equipment four to five orders of magnitude greater than proven technology can guarantee. A number of experimental systems including both aqueous scrubbers and dry adsorbers have demonstrated decontamination capabilities in excess of 10,000. Small-scale, short-term engineering demonstrations using an actual dissolver off-gas stream as feed have produced overall decontamination efficiencies in excess of 1 million, and have indicated that the individual component efficiencies are not significantly reduced when several components are operated in series. Work is continuing on the many remaining uncertainties both in understanding basic I behavior and in demonstrating long-term dependability of attractive removal systems. Author (NSA)

N71-29859# Kernforschungszentrum, Karlsruhe (West Germany).

INORGANIC ADSORBER MATERIALS FOR TRAPPING OF FISSION PRODUCT IODINE

J. G. Wilhelm and H. Schuettelkopf *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 568-580 refs (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

Experimental work was performed to evaluate the usefulness of inorganic adsorber materials for iodine filtering devices. Special interest was concentrated on materials for off-gas cleaning in fuel reprocessing plants and gas cleaning inside the reactor containment under MCA conditions. Considering the high price of silver and the sensitivity of molecular sieves for acids, new inorganic adsorber materials were developed with relatively low silver loadings and high removal efficiencies for methyl iodide and iodine. Experimental data are given for the removal efficiencies of new inorganic adsorber materials in wet air and super-heated steam; besides, experiments are reported to evaluate the effect of nitrogen oxides on the performance of the adsorber materials. The efficiencies and the prices of the new materials are compared with those of silver impregnated molecular sieves. Author (NSA)

N71-29878# Northeastern Radiological Health Lab., Winchester, Mass.

INVESTIGATION OF A NUCLEAR FUEL REPROCESSING PLANT UPON ITS ENVIRONMENT

D. G. Smith *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 832-836 (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

To prevent unnecessary expenditures on hastily conceived environmental sampling and monitoring programs around the several planned nuclear fuel reprocessing plants, a project for development of a recommended methodology to enable agencies to carry out their responsibilities economically and accurately with a minimum of cost or inconvenience to the operators of these facilities is suggested. The objectives of this study are: To develop minimum and optimum requirements for environmental surveillance programs around nuclear fuel reprocessing plants; to develop a uniform set of surveillance methods that can be adopted by other states and companies in meeting surveillance needs; to identify specific radionuclides that may be released in liquid and gaseous waste discharges and the pathways by which they are dispersed in the environment; and to relate the levels of released radionuclides to levels in critical pathways in order to specify the most beneficial sampling and analyses to perform. Author (NSA)

N71-29881# WADCO Corp., Richland, Wash.

LEAKAGE FROM A CONTAINMENT VESSEL

Howard E. Hanthorn *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 841-857 refs (See N71-29851 17-13)
Avail: NTIS HC$6.00/MF$0.95

An attempt was made to obtain a unified expression for leakage flow from a nuclear reactor containment vessel. It was found that the curves for leakage rate versus containment vessel overpressure for the three flow regimes (viscous, turbulent, and orifice) were of the same general form and could be fitted with ample accuracy by empirical mathematical formulas of the same type, though the range of flow rate covered was six orders of magnitude. A single empirical formula was obtained covering all three flow regimes with sufficient accuracy for term calculations without regard to the actual flow regime, between 0.3 and 5 atm. overpressure. Author

N71-29919# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.

CALORIMETRIC MEASUREMENTS IN NUCLEAR ENGINEERING

J. Kott, S. Teren, and V. Jirousek 1970 6 p
(ZJE-84) Avail: AEC Depository Libraries

Information concerning the use of calorimeters developed in the SKODA Nuclear Power Plant's division for the measurement of the gamma radiation intensity is presented. This information is of great importance in the case of reactor structural materials, the heating of which due to radiation may deserve serious consideration. Author (NSA)

N71-30056# Bundesgesundheitsamt, Berlin (West Germany). Institut fuer Wasser-, Boden- und Lufthygiene.

SUITABILITY AND RELIABILITY OF INSTALLATIONS FOR TREATMENT OF RADIOACTIVE WASTE

K. Aurand, J. Arndt, and R. Wolter Jul. 1970 21 p refs In GERMAN
(NP-18621) Avail: AEC Depository Libraries

Sources of the waste, use of radioisotopes, tankage capacity, installation equipment, control of aqueous wastes, economics of waste processing and disposal, and safety procedures are considered. NSA

N71-30068 National Lending Library for Science and Technology, Boston Spa (England).
TNO TECHNOLOGY PROGRAMME FOR FAST BREEDER REACTORS
A. H. de Haas Van Dorsser 28 Oct. 1970 15 p Transl. into ENGLISH from Atoomenergie (Netherlands), v. 12, no. 4, Apr. 1970 p 131–137 Presented at the Meeting on Fast Reactors, Bunnik, Netherlands, 16 Sep. 1969
(NLL-Risley-Trans-1978-(9091.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The technological development of fast breeder reactors in connection with the industrial program is described. This includes calculations of temperature and stress distributions in components, considerable work as regard seals, bearings and fans, dimensioning of sodium pumps, development of an acoustic detector for cavitation measurement, testing and development of bearings, development of fabrication methods for bearing boxes, development of a mixer for mixing cold and hot streams of sodium with avoidance of thermal fatigue in the wall, construction of X-ray equipment for the study of internal bore welds, and the construction of optical systems for the remote control of repair work in heat exchangers. Author

N71-30101# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
INSPECTION FOR TIGHTNESS OF NUCLEAR REACTOR COMPONENTS BY HIGH SENSITIVITY METHODS
F. Ungr 1970 16 p refs
(ZJE-85) Avail: AEC Depository Libraries

The vacuum method using helium for leak testing of the reactor outlet piping is evaluated. Theoretical preparation of the test, analysis of sensitivity, testing equipment, influence of measuring system and time on the sensitivity of measurement, and the procedure of the test are described. Author (NSA)

N71-30141# Bundesgesundheitsamt, Berlin (West Germany). Inst. fuer Wasser-, Boden- und Lufthygiene.
CONTROL OF RADIOACTIVE WASTE FROM NUCLEAR FACILITIES [ZUR KONTROLLE RADIOAKTIVER ABWAESSER AUS KERNKRAFTWERKEN]
K. Aurand, J. Arndt, H. Ruehle, and R. Wolter Aug. 1970 26 p In GERMAN
(NP-18622) Avail: AEC Depository Libraries

The research showed that the radioactive waste in the discharge building was completely mixed with the coolant water. This waste is mixed under the research conditions with the strongest in the first 500 m flow stretch in flowing water; after about 4 km the dilution corresponds to that expected from the calculations; from 11.5 km up to the Rockenau dam stage, only a slight additional dilution occurs. About 40% of the Xe-133 escapes in the first 600 m flow length and 50% within the first 2.5 km. The degassing is then delayed and increases first in the passage through the Guttenbach power plant (72.2 km). At the Rockenau Dam 75% of the Xe-133 had escaped. The activity registered at the Rockenau Dam consists of 95% from Xe-133. The increased activity measured in the spring of 1969 in Rockenau was attributed to the drainage of radioactive rare gases with the wastes. Author (NSA)

N71-30142# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
PREDICTING THE HEAVY ELEMENT COMPOSITION OF IRRADIATED REACTOR FUELS
R. H. Clarke Jun. 1970 22 p refs
(RD/B/N-1722) Avail: AEC Depository Libraries

A method was developed which can be used to study the heavy element content of irradiated reactor fuels which have had any given rating history in the reactor followed by the desired subsequent cooling. The buildup and decay chains of all the probable isotopes from Th-230 to Cm-250 were considered. This covers the present range of interest and allows for extension to thorium or plutonium loaded fuels. The solution of the equations for the concentrations for all these isotopes were programmed into the code HYLAS which performs multienergy group burnups providing number densities, activities and spontaneous fission rates as a function of time within the fuel. Author (NSA)

N71-30143# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
THE THERMODYNAMICS OF SOME METAL/COOLANT REACTIONS IN MK 3 REACTORS
R. Hales and R. J. Pearce Oct. 1970 17 p refs
(RD/B/N-1816) Avail: AEC Depository Libraries

A thermodynamic assessment of the compatibility of metals and gaseous impurities in a helium atmosphere is presented. It is shown that, assuming thermodynamic equilibrium can be attained, the constituent elements of an alloy may exhibit different reactions with the gaseous impurities present in reactor coolant atmospheres. Reactions may be reversed by fluctuations in either gas composition or temperature. The pressure dependency for the possible carburizing reactions is indicated. Author (NSA)

N71-30208# Oak Ridge National Lab., Tenn.
ORNL ISOTOPIC POWER FUELS Quarterly Report, Period Ending 31 Dec. 1970
Eugene Lamb Feb. 1971 18 p refs
(Contract W-7405-eng-26)
(ORNL-4663) Avail: NTIS

On the basis of metallographic examination of compatibility test specimens W–26% Re seems to be the best container material for Cm-244(2)O3. Samples of hot pressed Cm-244(2)O3 pellets (two sizes) and Cm-244(2)O3 powder are being exposed to 600 ml of air-saturated distilled water and 600 ml of seawater to measure the rate of solution. The compound Cm-244Ir3 and alloys of this compound with iridium were proposed as isotopic power fuels. A preliminary study on a method of preparation and the determination of relevant properties of this fuel is underway. Calculations to determine the neutron shielding offered by 4 and 7 in. of LiH around the outside of the MHW generator were made. Eighteen Tm-170(2)O3 pellets and compatibility test metal disks were encapsulated. Equipment for measuring the vapor pressure of Tm2O3–Yb2O3 mixtures was assembled. New cladding materials are being developed for containment of radioisotopes in power systems for use in space. The addition of 1% Hf to the Pt-5% Mo alloy results in improved tensile strength at both room and elevated temperatures without impairing the ductility. Author (NSA)

N71-30209*# Arizona Univ., Tucson. Engineering Experiment Station.
NONLINEAR OSCILLATIONS AND STABILITY BOUNDS IN A NUCLEAR REACTOR WITH LINEAR REACTIVITY FEEDBACK Semiannual Report
Samuel Yee Jan. 1971 138 p refs
(Grant NGL-03-002-006)
(NASA-CR-119190; SAR-8) Avail: NTIS CSCL 18I

Systems of autonomous nonlinear differential equations describing the stability of a nuclear reactor with two reactivity feedbacks were analyzed to determine stability bounds. The system parameters used are representative of a fast reactor with in-core thermionic converters. Bounded regions are determined for the effective lifetime model and coupled temperature equations by means of computer surveys of exact solutions. The nature of the bounded trajectories indicates the existence of limiting planes in state space. A mathematical description of these planes yields results in close agreement with numerical calculations. All trajectories outside the bounded regions exhibit finite escape time. Stable domains in state space cannot be determined by observing the

effects of power perturbations alone. All three variables, power, and the two temperatures, must be varied. Concentric limit cycles have not been found for the effective lifetime model. Author

N71-30228# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION FUEL CYCLE TECHNOLOGY Quarterly Report, Oct. – Dec. 1970
D. S. Webster, A. A. Jonke, G. J. Bernstein, N. M. Levitz, R. D. Pierce et al Jan. 1971 33 p refs
(Contract W-31-109-eng-38)
(ANL-7767) Avail: NTIS

Work was done in the following areas: (1) further development of a head-end process for removing stainless steel cladding in a zinc bath by study of decladding rates, fission gas behavior, and reduction of declad fuel oxide; (2) investigation of a procedure for separating stainless steel cladding from fuel oxide by melting the cladding; (3) further laboratory-scale work to develop a fluid-bed process for the conversion of uranyl nitrate and plutonium nitrate in nitric acid solutions to an oxide form (UO_2-PuO_2) suitable for the fabrication of fuel shapes for LMFBR fuel; (4) additional development of X-ray fluorescence spectrometry as an in-line analytical method for determining the Pu/U ratio of oxide fuels during fabrication; and (5) continued investigation of the performance characteristics of a centrifugal contactor for the plutonium isolation steps in the solvent extraction of LMFBR fuels. Author (NSA)

N71-30313# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report, Period Ending 30 Sep. 1970
William E. Ray Dec. 1970 36 p refs
(Contract AT(30-1)-4135)
(WARD-4135-14) Avail: NTIS

Microcharacterization and mechanical property testing, including biaxial tensile, biaxial stress rupture, and both uniaxial and biaxial creep were continued on ARD vacuum melted materials. The results of stress rupture tests from seven lots of material representing various combinations of the independent variables were compared. Classification of the mode of rupture of post-test biaxial stress rupture specimens continued. Strain measurements of fifteen specimens were completed and results compared. Preliminary eddy current tests were made for two lots of tubing. Sixteen stress rupture tests were completed. Results from ARD, double vacuum melted, type 316 tubing, in the cold worked condition and in the annealed condition were compared. Upgrading of a uniaxial creep facility was initiated so that low stress creep data may be obtained. A total of 131 post-test stress rupture specimens were classified according to rupture type, stress level, and material, at both 1200 and 1300 F. Author (NSA)

N71-30314# Institute of Technology, Helsinki (Finland). Dept. of Technical Physics.
ON THE VARIETY AND HIERARCHY OF DATA EXTRACTION METHODS IN NUCLEAR REACTOR NOISE ANALYSIS
Bruno Baers 30 Dec. 1970 23 p refs
(TKK-F-A-137) Avail: AEC Depository Libraries

A review and systematic approach to the data extraction problem in nuclear reactor noise analysis was presented. A large number of signal representations and data extraction methods are obtained by using expansions of the fundamental joint probability and related quantities into sets of observable quantities and by using natural classification criteria specifying the experimental conditions. Most of the previously used and suggested techniques are members of this set. A large number of alternate or modified techniques can be suggested, some of which may be of practical interest. The hierarchy of representations given also indicates that the application of information theory to noise problems may be a useful and powerful approach. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-29267# California Univ., Livermore. Lawrence Radiation Lab.
SOME INNOVATIONS IN MAGNETIC CIRCUIT THEORY
R. W. Buntenbach 27 Oct. 1970 50 p refs Presented at the IEEE Professional Group on Circuit Theory Meeting, Los Angeles Sponsored by AEC
(UCRL-72828; CONF-710104-1) Avail: NTIS

It is shown that magnetic circuits can be analyzed, using the well-established principles of electric circuit theory. This is done by establishing a definition for magnetic impedance, replacing the resistance-reluctance analogue with a capacitance-permeance analogue, and using the gyrator as the interconnecting element between electric and magnetic circuits. The innovations presented offer the electric circuit engineer a fresh approach to the analysis of magnetic components. Author

N71-29268# California Univ., Livermore. Lawrence Radiation Lab.
ACOUSTIC EMISSION FROM COMPOSITE MATERIALS
Robert G. Liptai 3 Feb. 1971 28 p refs Presented at 2d ASTM Conf. on Composite Mater., Anaheim, Calif., 20–22 Apr. 1971 Sponsored by AEC
(UCRL-72657; CONF-710403-1) Avail: NTIS

A review of the application of acoustic emission analysis to the evaluation of material properties and defect structure is presented, including a brief discussion of experimental techniques. Sources of acoustic emission in composite materials under strain are discussed. Particular attention is directed toward fiber reinforced composites, and experimental results on filament wound NOL rings and vessels (glass-epoxy) are reported. It is concluded that acoustic emission data are helpful in establishing the mechanisms governing operative fracture modes and assessing structural integrity. Author

N71-29269 National Lending Library for Science and Technology, Boston Spa (England).
ACTIVATION OF FLOTATION ADHESION OF AIR BUBBLES BY THE ACTION OF ULTRASOUND AND OTHER FACTORS, AND ANALYSIS OF FORCES DETACHING MINERAL PARTICLES FROM THE BUBBLE [AKTIVATSIYA FLOTATSIONNOGO PRILIPANIYA VOZDUSHNYKH PUZYRKOV VOZDEISTVIEM ULTRAZVUKA I DRUGIKH FAKTOROV I ANALIZ SIL OTRYVA MINERALNYKH CHASTITS OT PUZYRKA]
V. A. Glembotskii et al Oct. 1970 23 p refs Transl. into ENGLISH from Proc. 9th Intern. Mineral. Congr. (USSR), 1970 p 167–176
(NLL-RTS-6124) Avail: Natl. Lending Library, Boston Spa, Engl.: 44s; 7 NLL photocopy coupons

The problems characterising the act of flotation adhesion of air bubbles and droplets of an apolar reagent to the surface of mineral particles, taking into consideration current data on the structure of water and hydrate layers are discussed. It is shown that the action of factors causing destruction of water and in particular of hydrate layers (ultrasound, temperature factor acting with time and others) has a most favorable influence on the attachment of bubbles and droplets. A theoretical analysis is given of detachment and adhesion forces and new concepts are established for the detachment of different size particles from bubbles under flotation conditions. Author

N71-29425# California Univ., Los Angeles. Dept. of Mathematics.
APPLICATIONS OF HARMONIC PRINCIPAL FUNCTIONS TO ELECTROSTATICS AND MAGNETOSTATICS
Dan Martinez Mar. 1971 24 p refs
(Grant DA-ARO(D)-31-124-71-G20)
(AD-721903; AROD-9653-10-M; TR-51) Avail: NTIS CSCL 20/3

In this report the author systematically applies the theory of harmonic principal functions to electro- and magnetostatics. Author (GRA)

N71-29512# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A NEW TRIANGULAR ACOUSTIC PULSE: ITS GENERATION AND UNIQUE PROPERTIES FOR NDT APPLICATIONS
N. E. Dixon and T. J. Davis Feb. 1971 35 p refs
(Contract AT(45-1)-1830)
(BNWL-1526) Avail: NTIS

A unique ultrasonic pulse technique for transmitting individual triangular-shaped (either compressional or rarefactional) acoustic pulses is described from which the received unipolar pulse signal exhibits no transducer resonance. The associated transducer model and theory, pulse spectral characteristics, and transducer performance requirements are detailed. Included are experimental data and a partial listing of many inherent advantages of the unipolar pulse such as extremely high range resolution, the complete absence of field effects, extremely broad continuous spectral frequency content, and penetration characteristics. Also presented are some specific nondestructive testing applications. Author

N71-29513# Pittsburgh Univ., Pa. Dept. of Physics.
CAUSALITY PROBLEMS AND INDEFINITE METRIC OF QUANTIZED FIELDS
B. Schroer Sep. 1970 23 p refs Presented at the Conf. on Spec. Topics in Quantum Field Theory, St. Louis, 27–31 Jul. 1970
(Contract AT(30-1)-3829)
(NYO-3829-58; CONF-700710-3) Avail: NTIS

A brief survey of causality problems and the indefinite metric in quantum field theory is presented. Some of the concepts are explained, and some theorems are stated. NSA

N71-29624# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF HYDROACOUSTICS
A. M. Tyurin et al 9 Feb. 1971 423 p refs Transl. into ENGLISH of the book 'Osnovy Gidroakustiki' Leningrad, Izd-Vo Sudostroyeniye, 1966 p 1–295
(AD-722293; FTD-MT-24-03-71) Avail: NTIS HC $6.00/MF $0.95 CSCL 20/1

The book is intended as a training manual in the field of hydroacoustics. Included in this text are topics on Propagation of acoustic waves in a uniform elastic medium, Radiation and scattering of acoustic waves, The directional effect of radiators, Hydroacoustic converters, Propagation of sound in the sea, Methods of direction finding, Principles of hydroacoustic stations, Range of action of hydroacoustic instruments, and Methods of hydroacoustical measurement. GRA

N71-29634 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF FLASHOVERS ACROSS DIELECTRIC SPACERS IN COMPRESSED GASES OF A COAXIAL CYLINDER SYSTEM
E. S. Maizel 1970 11 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 12, Dec. 1969 p 19–23
(NLL-CE-Trans-5434-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Results are given of investigating surface flashover across solid dielectric spacers in compressed gases (nitrogen, sulphur hexafluoride, and a mixture of the two) in a coaxial cylinder system. The effect of the type of gas, the pressure, the material and shape of the spacer surfaces on the flashover voltage are examined. Recommendations are given for selecting insulation for such high voltage equipment as low-capacitance cable cross-connections. Author

N71-29653 California Univ., Los Angeles.
ENERGY DISSIPATION IN A LIQUID FILLED PRECESSING SPHERICAL CAVITY AND APPLICATION TO SATELLITES
James Patrick Vanyo (Ph.D. Thesis) 1969 174 p
Avail: Univ. Microfilms Order No. 70-14334

A method and apparatus for experimentally measuring energy dissipation in a nonrigid dissipative spinning and precessing system are described. The method and apparatus are applied to the measurement of energy dissipation caused by motion of liquids in a liquid filled spherical cavity. The value of the net moment applied by the liquid to the cavity wall is determined. This determination permits the time rate of change of the net angular momentum of the liquid to be studied. An alternate explanation in terms of the participation of the liquid in the effective inertia tensor of the liquid-rigid body system is made. A dominant feature of the experimental results is the growth of turbulence with high rates of energy dissipation at precession rates of several revolutions per minute. The experimental energy dissipation rates for the turbulent region are compared to three analytical models. Dissert. Abstr.

N71-29654 Brown Univ., Providence, R.I.
SUPERHEATING, SUPERCOOLING, AND SURFACE SUPERCONDUCTIVITY OF PURE TYPE-I SUPERCONDUCTORS AND THEIR ALLOYS
Frederick William Smith (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-8793

The magnetic response of several pure Type-I superconductors, viz., Sn, In, Tl, Pb, and Hg, with special emphasis placed on the observation of metastable (superheated and supercooled) states was investigated. Also studied was the magnetic response of Type-I and Type-2 superconductors, in a series of Sn-In alloys, as a function of electron mean free path. An electronic ac mutual inductance bridge, operating at 1 kc, is used for the determination of the real part of the differential ac susceptibility, for the superconductors studied. Ac losses, proportional to the imaginary part of the ac susceptibility, at 1 kc are found to be greater in the intermediate and surface sheath states than in the normal state. Dissert. Abstr.

N71-29701 National Lending Library for Science and Technology, Boston Spa (England).
BIMETRICAL FORMALISM IN THE GENERAL THEORY OF RELATIVITY AND THE LAWS OF CONSERVATION [DVUKHMETRICHESKII FORMALIZM V OBSHCHEI TEORII ZOTNOSITELNOST I ZAKONY SOKHRANENIYA]
Yu. G. Sbytov Dec. 1970 10 p refs Transl. into ENGLISH from Izv. Vuz. Fizika (USSR), no. 4, 1963 p 48–55
(NLL-RTS-5731) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.80; 3 NLL photocopy coupons

The conservation laws in the general theory of relativity are investigated using two metrics, and employing Noether's theorem in a generalized form. The differential identities so obtained, unlike the usual identities, are covariant and they are connected with definite conservation laws. Integral forms of the conservation laws are considered as well as their differential form, introduced by covariant integration. Expressions for the energy-momentum of the gravitational field are studied. Author

N71-29703 Ohio State Univ., Columbus.
NOISE GENERATED BY TURBULENT NON-PREMIXED FLAMES

Paul Reginald Knott (Ph.D. Thesis) 1969 136 p
Avail: Univ. Microfilms Order No. 70-14056

A study was made of the nonresonant noise produced from two configurations of non-premixed flames: 1) flames from co-flowing jets of fuel and oxidizer and 2) flames from impinging jets of fuel and oxidizer. The noise of these flames was found to qualitatively agree with simple monopole source of sound model; but for the flames of co-flowing jets, (taking into account convection and refraction effects), the flames did not act like a simple collection of monopole sources of sound. For the different reactants considered, the simple fuel mass flow rate was found to correlate the acoustic combustion efficiency linearly. Dissert. Abstr.

N71-29703 Rensselaer Polytechnic Inst., Troy, N.Y.
SEARCH FOR ACTIVE INTERACTIONS AND MEASUREMENTS OF THE RESISTIVITY TENSOR IN SUPERCONDUCTING INDIUM
Joseph Leagrand Mundy (Ph.D. Thesis) 1969 164
Avail: Univ. Microfilms Order No. 70-11328

The superconducting state is evaluated as a median for wave particle interaction leading to amplification. The pure superconducting state is shown to be unattractive on a theoretical basis. The intermediate state in indium is investigated experimentally in terms of the resistivity and Hall effect. The results are compared with the work of others and interpreted in terms of wave properties as pertains to amplification. The Hall angle in the intermediate state can be accounted for by the normal state electron behavior in a magnetic field. The behavior of the intermediate state resistance can be accounted for by the laminar model more consistently than the flux tube model. Also an anomalous trasverse voltage is observed that reverses with magentic field polarity but not current. This is interpreted in terms of domain orientation and is shown to play a role in helicon wave behavior in the intermediate state. Dissert. Abstr.

N71-29704# California Univ., Los Angeles. Dept. of Mathematics.
APPLICATIONS OF P-HARMONIC PRINCIPAL FUNCTIONS TO THERMODYNAMICS AND ELECTRO- AND MAGNETOSTATICS
Dan Martinez Mar. 1971 23 p refs
(Contract DA-ARO-D-31-124-71-G20)
(AD-721904; TR-52; AROD-9653:11-M) Avail: NTIS CSCL 20/3

The purpose of this report is to apply the theory of P-harmonic principal functions to thermodynamics and electro- and magnetostatics. Author (GRA)

N71-29770# Pennsylvania State Univ., University Park. Ordnance Research Lab.
UNDERWATER ACOUSTIC SCATTERING AND ITS EFFECT ON BINARY DECODING
Louis A. King 13 Jul. 1970 103 p refs
(Contract N00017-70-C-1407)
(AD-722404; TM-213-03) Avail: NTIS CSCL 20/1

The paper is based on an experimental study of the amplitude fluctuation in underwater acoustic pulses and its dependence on range, acoustic frequency, and pulselength. The fluctuation is assumed to be a result of spatial variation in the refractive index field. The coefficient of variation, a measure of the relative amplitude fluctuation, is used to compare experimental results with theoretical predictions. For large values of the wave parameter, the theoretical coefficient of variation has a first-power dependence on the acoustic frequency and a 1/2-power dependence on the range. Experimentally, this quantity was found to display a 7/10-power relation and a 1/2-power relation with the acoustic frequency and range, respectively. The variance of the signal portion of a correlator output is shown to be proportional to the mean-square value of the signal amplitude fluctuation which, according to theory, is proportional to the square of the acoustic frequency and the first power of the range. Because the effective scatterers are highly directional, the major contribution of scattered energy comes from the region of a cone whose axis lies along a line joining the source and receiver and whose apex is located at the receiver. It is reasoned that the increment in pulselength served to insonify scatterers outside the cone, thereby producing scattered energy not directed to the receiver. Author (GRA)

N71-29816*# Translation Consultants, Ltd., Arlington, Va.
QUANTUM MECHANICS AS A THEORY OF RELATIVISTIC BROWNIAN MOTION [KVANTOVAYA MEKANIKA KAK TEORIYA RELYATIVISTSKOGO BROUNOVSKOGO DVIZHENIYA]
Yu. A. Rylov Washington NASA Jul. 1971 33 p refs Transl. into ENGLISH from Russian report No. PR-15, 1970 41 p
(Contract NASw-2038)
(NASA-TT-F-13735) Avail: NTIS CSCL 20J

It is shown that nonrelativistic quantum mechanics can be discussed as a variant of the relativistic statistical theory which describes the random motion of a classical particle. The relativity of the theory consists of the fact that a relativistic concept of the particle's state is used in describing the particle's behavior. This situation is fundamental because the statistics are the calculation of states and the result depends on what is designated a state. Author

N71-30027* Bausch and Lomb, Inc., Rochester, N.Y.
PETZVAL TYPE OBJECTIVE INCLUDING FIELD SHAPING LENS Patent
Guy V. Coniglio, inventor (to NASA) Issued 30 Jul. 1968 3 p Filed 25 Sep. 1963 Cl. 350-2 Sponsored by NASA
(NASA-Case-GSC-10700; US-Patent-3,394,975; US-Patent-Appl-SN-311387) Avail: US Patent Office CSCL 20F

The development of a Petzval type of objective for focusing light of a specified wavelength band upon a curved photoreceptor is discussed. The device consists of simple optical components and is capable of wide band transmission of the order of .32 micron to .6 micron. Official Gazette of the U.S. Patent Office

N71-30057 Michigan Technological Univ., Houghton.
THE EFFECT OF LOCAL MODIFICATIONS OF THE EIGENVALUES AND EIGENVECTORS OF DAMPED LINEAR SYSTEMS
Robert John Pomazal (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms Order No. 70-13559

An analytical procedure for determining the effects of localized stiffness, damping, and inertia changes on the eigenvalues and eigenvectors of linear vibration systems is presented. Known eigenvalues and eigenvectors of an unmodified system are used to generate the modified eigenvectors and modified characteristic equation directly, without solving the modified eigenvalue problem explicitly. The primary advantage of this method lies in the ease with which the solution of the modified system is obtained; the modified characteristic equation is of a form which is ideally suited to numerical solution by the Newton–Raphson iteration procedure, and the modified eigenvectors are evaluated by simple matrix multiplications. Dissert. Abstr.

N71-30138 National Lending Library for Science and Technology, Boston Spa (England).
SCATTERING OF LIGHT BY PHASE SEPARATED GLASSES
L. Prodhomme 17 Nov. 1970 18 p refs Transl. into ENGLISH from Verres Refractaires (Paris), v. 22, no. 6, Nov.–Dec. 1968, p 604–613
(NLL-PORS-2696-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The application of light scattering to the study of the phase separation in sodium borosilicate glasses was undertaken with the

intention of following the initial stages of the process of separation by trying to measure the smallest possible phase domains. An empirical method of extrapolation applied in the range of dimensions between 500 and 2000 A gave results that agree well with those obtained by electron microscopy. The phenomenon of diffraction extends over a considerable number of elements and permits a dimension to be attributed to a periodic structure which could have been masked by a too complex structure. Thus in the case of phase separation by spinodal decomposition, the determination of a characteristic wavelength gives an average measurement of the degree of connectivity of the structure. Author

N71-30207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MECHANICAL INTERACTION OF A DRIVEN ROLLER (WHEEL) ON SOIL SLOPES. THE NECESSARY CONDITIONS FOR AN EQUILIBRIUM-VELOCITY SOLUTION. PART 1
Isak Kloc 15 Jun. 1971 80 p refs
(Contract NAS7-100)
(NASA-CR-118988; JPL-TM-33-477-Pt-1) Avail: NTIS CSCL 20K

A general solution is given to the mobility performance problem of a power-driven rigid cylindrical roller climbing a semi-infinite soft soil slope with uniform velocity. The roller axle is subjected to vertical and pull force components. A gravitating, cohesive-frictional soil is considered. Its application to lunar and planetary locomotion is emphasized. The mechanics of soil-roller interaction is described and solved, considering stresses and velocities, as a mixed boundary value problem. Kotter's quasi-static equilibrium equations are connected to a plastic stress configuration satisfying Shield's velocity conditions along the characteristic lines. Solutions of the equilibrium equations yield the driving torque, slip, sinkage, and soil-roller interface stresses. Driving power requirements and thrust efficiency are determined. A general concept for safety factor against immobilization is introduced. A computer program for the soil-wheel interaction performance (SWIP) was developed and limited applications of this theory to rigid wheel tests on horizontal terrains indicate very reasonable agreement. The method is also applied to the Apollo and Lunokhod-1 lunar roving vehicle wheels. Author

N71-30208*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
STATISTICAL ENERGY METHODS Final Report, 18 May 1969 – 18 May 1970
Jerome E. Manning and Paul J. Remington 26 Mar. 1971 122 p refs
(Contract NAS5-21020)
(NASA-CR-118987; BBN-2064) Avail: NTIS CSCL 20A

A method of vibration analysis, commonly called Statistical Energy Analysis (SEA) was developed to study the dynamic behavior of large, complex structures and acoustic spaces. A review of the concepts of SEA is presented, and the SEA predictions on a simple coupled structure are compared with exact calculations. In conclusion, general guidelines for the application of SEA to dynamical problems are offered. E.M.C.

N71-30210# California Univ., Los Angeles. Dept. of Physics.
PAIR CORRELATIONS IN A FERROMAGNETIC COLLOID
P. G. Gennes and P. A. Pincus 1970 22 p refs Prepared in cooperation with Centre National de la Recherche Scientifique, Paris, France
(Contract N00014-69-A-0200-4006)
(AD-722712) Avail: NTIS CSCL 7/4

The authors discuss some properties of the equation of state and of the static correlations for spherical ferromagnetic grains, at thermal equilibrium, in a passive fluid. At high external fields H, low concentrations, and not too high temperatures, the grains tend to form chains along the directions of H. In zero field (but otherwise identical conditions), some chains are still present but oriented at random and in competition with closed rings and clusters. Various experimental methods which could give information on these chain structures are listed. Author (GRA)

N71-30229# Hughes Research Labs., Malibu, Calif.
RESEARCH IN INTERACTION OF COHERENT LIGHT WITH SOLIDS AND WITH TURBULENT ATMOSPHERES Final Scientific Report
W. P. Brown Feb. 1971 241 p refs
(Contract AF 49(638)-1607)
(AD-722475; AFOSR-TR-71-0582) Avail: NTIS CSCL 20/6

The report summarizes the objectives and results of research on propagation in random media conducted on Contract AF49(638)-1607. The principal results include the derivation of a validity condition for the Rytov approximation, the development of diagrammatic summation techniques for treating multiple scattering effects, and the development of nondiagrammatic techniques for deriving equations for the statistical moments of a wave propagating through a random medium. Author (GRA)

N71-30291*# Stevens Inst. of Tech., Hoboken, N.J. Cryogenics Center.
EXPERIMENTAL INVESTIGATIONS OF DESORPTION COOLING METHODS AT CRYOGENIC TEMPERATURES Final Report, May 1968 – Jun. 1970
John G. Daunt May 1971 37 p refs
(Grant NGR-31-003-043)
(NASA-CR-119184) Avail: NTIS CSCL 20L

Results are given on the performance of two low temperature desorption refrigeration systems which were investigated experimentally. Using He-4 as the working gas and synthetic zeolite as the working substance, it was found that temperatures down to 1.6K could be readily obtained. Measurements were made of the rate of warm-up under various power loadings (powers up to 12.8 milliwatts were employed) at the final low temperatures. With the larger cryostat containing 130 g of synthetic zeolite refrigeration was maintained for periods longer than 25 hours. An assessment was made on the limitations of the cooling process. The data are presented in tabular form for the expected duration of refrigeration and total refrigerative capacity at various temperature levels from 3K to 6K for one kilogram of synthetic zeolite; as an example, this would permit refrigeration to be maintained between 4K and 5K for 130 hours for a 1 milliwatt power loading. Author

N71-30292* Bausch and Lomb, Inc., Rochester, N.Y.
ILLUMINATION SYSTEM INCLUDING A VIRTUAL LIGHT SOURCE Patent
Joseph F. Hall, Jr., inventor (to NASA) Issued 8 Mar. 1966 5 p Filed 31 Jan. 1961 Cl. 240-41.36 Sponsored by NASA
(NASA-Case-HQN-10781; US-Patent-3,239,660; US-Patent-Appl-SN-86018) Avail: US Patent Office CSCL 20F

An illumination system suited for use as a sun simulator in a space environment simulator is described. The system includes plural, spaced light sources and a means for combining their outputs to form a single virtual light source, the intensity of which varies with the number of individual real sources which are selectively energized at any one time. A multi-faceted reflector distributes the light received from the real sources over a relatively wide angle and directs it toward a collimating reflector which illuminates the desired field. J.M.

N71-30293 Ohio State Univ., Columbus.
THE VELOCITY OF SECOND SOUND AND THE INERTIAL MASS OF He-3 IN (He-3)-(He-4) MIXTURES
Nickson Randolph Brubaker (Ph.D. Thesis) 1969 152 p Prepared in part for Miami Univ., Oxford, Ohio
Avail: Univ. Microfilms Order No. 70-13989

The velocity of second sound was measured between 0.028 K and 0.6 K in He-3-He-4 mixtures with He-3 concentrations from

0.143% to 6.278%. Second sound was generated by an electrostatic transducer with a porous diaphragm which was permeable to the superfluid. The diaphragm pores were small enough that the moving diaphragm could directly create density fluctuations in the normal fluid without creating fluctuations in the total density. The second sound receiver was an identical transducer operating as a capacitive microphone. The velocity was determined by measuring the time of flight of single pulses of second sound. A hydrodynamic equation for the velocity of second sound was solved to give an expression for the normal fluid density in terms of the second sound velocity and the derivative of the osmotic pressure with respect to the He-3 number density. The inertial mass was obtained as a function of concentration and temperature for the vapor pressure data. Dissert. Abstr.

N71-30312# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
CORRESPONDENCE PRINCIPLE IN QUANTUM FIELD THEORY
Yoichi Iwasaki Mar. 1971 8 p refs
(RIFP-119) Avail: NTIS

It was demonstrated that the Correspondence Principle does not hold in general in quantum field theory, proving that in a model of scalar-tensor gravitation the perihelion advance is predicted to be different from classical theory in quantum field theory. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-29210# California Univ., Livermore. Lawrence Radiation Lab.
AN INTEGRATED SYSTEM FOR PRODUCTION OF NEUTRONICS AND PHOTONICS CALCULATIONAL CONSTANTS. VOLUME 2: A BIBLIOGRAPHY OF THE EXPERIMENTAL DATA OF NEUTRON INDUCED REACTIONS
R. J. Howerton, S. T. Perkins, C. P. Altamirano, and K. L. Hill 1 Oct. 1970 801 p refs
(UCRL-50400-Vol-2) Avail: NTIS HC$9.00/MF$0.95

A tabulation of the bibliographic citations in the Experimental Cross Section Information Library (ECSIL) as of October 1, 1970 is presented. The tabulation is in three arrangements: alphabetic by publications, author index, and accession number. Author (NSA)

N71-29230# California Univ., Davis.
CROCKER NUCLEAR LABORATORY Annual Report, 1 Aug. 1969 - 31 Jul. 1970
John A. Jungerman and William W. True 1 Sep. 1970 92 p refs
(Contract AT(11-1)-GEN-10)
(UCD-CNL-125) Avail: NTIS

Differential cross sections for carbon-12 proton reactions (p,Li-6) at 45 MeV are reported as well as the energy dependance of quasi-free scattering in deuterium (p,2p) reactions at 15 to 50 MeV and phase shift analysis of helium-3 proton elastic scattering at 18 to 40 MeV. Neutron scattering cross sections for hydrogen at 24 to 60 MeV are also given. Model analysis of krypton-76, 78, 80, 82, and 84 energy level schemes from (alpha, xn) reactions and lead-200, 202, 204, and 206 from (alpha,2n) reactions are included with the gamma spectra form mercury-198 (alpha,2n gamma) reactions. J.M.

N71-29232# Oak Ridge National Lab., Tenn.
PRIMARY AND SECONDARY PARTICLE CONTRIBUTIONS TO THE DEPTH DOSE DISTRIBUTION IN A PHANTOM SHIELDED FROM SOLAR FLARE AND VAN ALLEN PROTONS
R. T. Santoro, H. C. Claiborne, and R. G. Alsmiller, Jr. 18 Feb. 1971 33 p refs Presented at the Symp. on Nat. and Manmade Rad. in Space, Las Vegas, 1 - 5 Mar. 1971
(ORNL-TM-3320; CONF-710304-3) Avail: NTIS

Calculations were made using the nucleon-meson transport code, NMTC, to estimate the absorbed dose and dose equivalent distributions in astronauts inside space vehicles bombarded by solar-flare and Van Allen protons. A spherical shell shield of specific radius and thickness with a 30 cm diam tissue ball at the geometric center was used to simulate the spacecraft-astronaut configuration. The absorbed dose and the dose equivalent from primary protons, secondary protons, heavy nuclei, charged pions, muons, photons, positrons and electrons are given as a function of depth in the tissue phantom. Results are given for solar-flare protons with a characteristic rigidity of 100 MV and for Van Allen protons in a 240 n. mi. circular orbit at 30 deg inclination angle incident on both 20 g/sq cm-thick aluminum and polyethylene spherical shell shields. Author (NSA)

N71-29247# Los Alamos Scientific Lab., N.Mex.
PROCEEDINGS OF THE FOURTH LAMPF USERS MEETING
Lewis E. Agnew, Katherine Harper, and Billie F. Miller, comps. Mar. 1971 94 p refs Meeting held at Los Alamos, 30 - 31 Oct. 1970
(Contract W-7405-eng-36)
(LA-4578) Avail: NTIS

A summary of the activities of the working groups is presented. Topics include the stopped muon channel, low energy pion channel, energetic pion channel and spectrometer, high energy pion channel, nucleon physics laboratory, high resolution proton spectrometer, nuclear chemistry, and the computing facilities. A brief description of the planned experimental facilities is presented. Author (NSA)

N71-29250# California Univ., Santa Barbara. High Energy User Group.
[HIGH ENERGY PHYSICS] Progress Report, May 1970 - Mar. 1971
David O. Caldwell Mar. 1971 16 p refs
(Contract AT(04-3)-34)
(UCSB-34-P-135-14) Avail: NTIS

The research performed on high-energy interactions covers the total (photon,p) and (photon,n) cross sections up to 18 GeV, total photosbsorption cross sections for complex nuclei up to 18 GeV, high-energy inelastic Compton scattering, and the interaction of short-lived particles with nucleons. The computer facility is also discussed. A list of publications is included. NSA

N71-29261# McElroy (Ralph) Co., Austin, Tex. Custom Div.
QUADRUPOLES EXPOSED TO RADIATION [STRAHLENEXPONIERTE QUADRUPOLE]
Ch. Perret et al [1971] 15 p Transl. into ENGLISH of German report SIN-TM-08-5
(LA-tr-71-1; SIN-TM-08-5) Avail: NTIS

The design of quadrupole magnets for transporting pion beams in intense radiation fields is considered. Two standard quadrupole types (differing in size) are proposed for all radiation-exposed target discharges. Higher power costs (due to greater resistivity) for Al must be weighed against corrosion of Cu for water cooling. Both problems can be eliminated by cooling with gaseous He, but extra expenditures are incurred for He gas blowers. NSA

N71-29270# Washington Univ., Seattle. Dept. of Physics.
QUADRUPOLE SURFACE OSCILLATIONS AND THE

ELASTIC FORM FACTOR OF O-16 AND C-12
J. L. Friar Sep. 1970 20 p refs Sponsored in part by AEC
(RLO-1388-597) Avail: NTIS

By using a volume-conserving liquid-drop model for quadrupole surface oscillations, the elastic form factors for O-16 and C-12 were calculated. It is shown that zero-point oscillations of the quantized drop produce an effective charge density which differs from that of the uniform, unquantized drop by having a reasonable skin thickness. The resulting elastic form factors are in reasonable agreement with recent experimental data. The transition density for exciting the lowest quadrupole state in this model is shown to be the same as that of Tassie's hydrodynamical model. Author (NSA)

N71-29271# California Univ., Berkeley. Lawrence Radiation Lab.
OPTICALLY DETECTED MAGNETIC RESONANCE OF MOLECULES IN EXCITED TRIPLET STATES
Michael J. Buckley Feb. 1971 189 p refs
(Contract W-7405-eng-48)
(UCRL-20390) Avail: NTIS

The sensitivity of optically detected magnetic resonance (ODMR) as a function of the intramolecular energy transfer processes is developed along with the explicit form of the spin Hamiltonian used in ODMR with zero external magnetic field. The main features of the optically detected ESR and ENDOR spectra in zero field for molecules with one I = 1 or I = 3/2 nuclear spin is presented. The optically detected ESR spectra of the triplet pi-pi* state of 8-chloroquinoline, the triplet n-pi* state of pyrazine, and the triplet pi-pi* state of paradichlorobenzene are reported. In addition the Cl-35 and Cl-37 ENDOR spectra are reported for the excited triplet states of 8-chloroquinoline and paradichlorobenzene. The observed ODMR spectra are interpreted in terms of a spin Hamiltonian incorporating the electron spin-spin, nuclear quadrupole, and nuclear-electron hyperfine interactions. The triplet pi-pi* state of 8-chloroquinoline is found to have essentially the same values for the electron spin-spin interaction as the triplet pi-pi* state of quinoline. The chlorine nuclear quadrupole coupling constant of the triplet pi-pi* state of 8-chloroquinoline is approximately the same as the values reported for the ground state of similar molecules, indicating that the chlorine electric field gradient is not significantly changed upon excitation. Author

N71-29281# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.
CALCULATION OF THE ACTIVITY PRODUCED BY IRRADIATION OF THIN TARGETS WITH HIGH ENERGY NEUTRONS. NEURAK PROGRAM [BERECHNUNG DER ERZEUGTEN AKTIVITAET BEI DER BESTRAHLUNG VON DUENNEN TARGETS MIT ENERGIEREICHEN NEUTRONEN. RECHENPROGRAMM NEURAK]
H. Muenzel and K. Schmidt Oct. 1970 39 p In GERMAN
(NP-18649) Avail: AEC Depository Libraries

A computer program is described whereby the activities produced by the bombarding of thin targets by high-energetic neutrons may be calculated. The program requires values of the excitation function and neutron spectra. Author (NSA)

N71-29287# Atomic Energy Commission, New York. Health and Safety Lab.
NEUTRON SPECTRA IN THE SIDE SHIELDING OF A LARGE PARTICLE ACCELERATOR
Keran O'Brien Jan. 1971 31 p refs
(HASL-240) Avail: NTIS

Neutron spectra covering the range from thermal to 500 MeV in the side-shielding of high energy electron and proton accelerators were calculated. Shield thicknesses vary from 100 to 2000 g/sq cm of earth and iron. The results should be applicable to particle accelerators with energies greater than 0.8 GeV under conditions of uniform beam loss. Author (NSA)

N71-29288# Sandia Corp., Albuquerque, N.Mex.
L-SHELL AUGER, COSTER-KRONIG AND RADIATIVE MATRIX ELEMENTS, AND AUGER AND COSTER-KRONIG TRANSITION RATES IN j-j COUPLING
Eugene J. McGuire Mar. 1971 64 p refs Sponsored by AEC
(SC-RR-710075) Avail: NTIS

All the matrix elements used to compute L-shell fluorescence yields are tabulated. Also included are the transition rates in j-j coupling. Author (NSA)

N71-29289# Rensselaer Polytechnic Inst., Troy, N.Y.
INTEGRAL TESTS AND EVALUATION OF CROSS SECTION DATA FROM STUDIES OF FAST NEUTRON TRANSPORT IN BULK MEDIA
B. K. Malaviya, N. N. Kaushal, M. Becker, E. T. Burns, A. Ginsberg et al [1970] 7 p refs
(Contract AT(30-1)-328)
(RPI-328-225) Avail: NTIS

A comprehensive program devoted to the integral checks of differential microscopic-cross-section data pertinent to the LMFBR Program, based on the study of fast neutron transport in bulk media, is described. Time-of-flight measured fast-neutron angular flux spectra at different positions in a simple, clean, homogeneous assembly are analyzed using ENDF/B data, MC(2), and SN transport calculations. In addition, continuous-slowing-down theory is developed to complement precise calculations by indicating direct relationships between cross-section uncertainties and spectra and by permitting comparisons with other data files. The result is a well-defined integral experiment with clear-cut interpretation. Most progress was made for iron. On the basis of cross-section uncertainties in iron and of their influence on spectra, it is possible to recommend not only preferred data, but also a redirection in emphasis in differential measurements and evaluation. Similar studies are in process for other materials and for new ENDF/B versions. Author (NSA)

N71-29290# Sandia Labs., Albuquerque, N.Mex.
ENERGY AND ANGULAR DISTRIBUTIONS OF ELECTRONS EJECTED FROM N2 BY ELECTRON IMPACT
G. C. Tisone Mar. 1971 41 p refs
(SC-RR-710050) Avail: NTIS

Energy and angular distributions of electrons ejected from N2 after ionization by electrons with energies of 500, 750, and 1000 eV were measured using crossed molecular and electron beams. The ejected-electron spectra at selected angles were measured for ejected energies up to 500 eV with an energy resolution of Delta E = 0.015 E at fwhm. The energy spectra were measured between 40 deg and 115 deg where a maximum in the number of ejected particles occurs. Measurements were made at 5 deg intervals with an angular resolution of 2 deg. Absolute cross sections, differential in energy and angle, were obtained by normalization to absolute elastic scattering cross sections. Estimates of the K-shell ionization cross section for 750-eV and 1000-eV incident electrons were obtained. Author (NSA)

N71-29291# Michigan State Univ., East Lansing.
[PARTICLE PHYSICS] Progress Report, Feb. 1971
1971 9 p refs
(Contract AT(11-1)-1810)
(COO-1810-7) Avail: NTIS

Research on field theory using a lattice model, model of fermions using double-valued wavefunctions, the random phase approximation quark model, automatic numerical integration, pion-nucleus scattering, and the interaction of pions with deuterium is briefly summarized. NSA

N71-29296# Los Alamos Scientific Lab., N.Mex.
A METHOD FOR MEASURING THE ENERGY AND INTENSITY OF A PROTON BEAM BY DETECTING

FORWARD SCATTERED ELECTRONS
Peter A. M. Gram Dec. 1970 11 p refs
(Contract W-7405-eng-36)
(LA-4612) Avail: NTIS

By using a GeLi detector to measure, with high precision, the energy of electrons scattered forward by the proton beam in a thin beryllium foil, it appears possible to measure the proton energy (around 800 MeV) to better than 0.1%. Author (NSA)

N71-29289# Brookhaven National Lab., Upton, N.Y.
AGS INJECTION WITH 200 MeV LINAC
J. Claus 12 Jan. 1971 27 p refs
(BNL-15646) Avail: NTIS

Multiturn injection in synchrotrons is considered in order to indicate conditions for which beam losses remain small. After describing the present mode of injection into an alternating gradient synchrotron, (AGS), the use of matched beams is advocated as a means to circumvent certain space-charge effects. Methods for filling both the horizontal and the vertical phase space and for establishing tolerances for the betatron frequencies are described. It appears desirable to install quickly variable quadrupoles, to be used to compensate for the frequency shifts induced by the accumulating current in the circulating beam. Injection with a stepped closed orbit appears to require less aperture in the synchrotron than injection of a comparable beam with a continuously moving closed orbit. The conclusion is that 44-turn injection, in view of the relationship between brightness and current of the linac beam, is to be preferred above injection of a few revolutions with a larger beam. Author (NSA)

N71-29363# Addis Translations International, Woodside, Calif. Stanford Linear Accelerator Center, Calif.
POSSIBILITY OF COMPENSATING A BEAM ENERGY SPREAD DUE TO CURRENT LOADING [O VOZMOZHNOSTI KOMPENSATSII ENERGETICHESKOGO RAZBROSA PUCHKA, VNOSIMOGO TOKOVOI NAGRUZKOI]
I. A. Grishaev et al Dec. 1970 10 p refs Transl. into ENGLISH of Akad. Nauk Ukr. SSR, Fiz. -Tekhn. Inst., Kharkov, report KhFTI-70-13
(SLAC-Trans-129; KhFTI-70-13) Avail: NTIS

A method which ensures complete energy-spread compensation for any number of accelerator sections in the transient regime is proposed. The method involves a variation of the output bunch phase in the injector during the pulse in accordance with a law that ensures an equal increment in the energy of the particles in each bunch in the main accelerating channel. The fact that different bunches experience beam radiation fields of different amplitude is taken into account. The compensation conditions can also be satisfied by changing the phase velocity of the wave during the pulse in the main part of the accelerator. Calculations and measurements obtained in the course of applying the above method of compensation are reported. NSA

N71-29369# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
M CENTERS AND COMPLEX CENTERS IN IONIZED CRYSTALS [CENTRES M ET CENTRES COMPLEXES DANS LES CRISTAUX IONIQUES]
M. Romero Mar. 1971 49 p refs In FRENCH
(ONERA-DERTS-NT-02-23) Avail: NTIS

Far ultraviolet radiation transmission in magnesium fluoride is affected by the presence of defects induced by ionizing radiation. If one excludes the very low temperature range, defects leading to noticeable absorption level are the complex centers (M, N, R) and the associated ionized centers (M+, M', etc.). The models and the behavior in alkali halogenides and alkaline earth metal halides are analyzed. ESRO

N71-29445# Los Alamos Scientific Lab., N.Mex.
POLARIZATION EFFECTS IN NEUTRON-HELIUM SCATTERING AND THE T(d,n)He 4 REACTION
William B. Broste Jan. 1971 154 p refs
(Contract W-7405-eng-36)
(LA-4596) Avail: NTIS

Measurements were taken of the polarization function in the scattering for incident neutron energies of 11.0, 17.7, 23.8, 25.7, 27.3, and 30.3 MeV. The measurements were used to derive more accurate values for the polarization analyzing power of n-alpha scattering, in order that the polarization of the neutrons from the T(d,n)He-4 reaction could be determined with greater certainty. Single-energy phase-shift analyses of available n-helium scattering data were made for each of the six energies. Measurements were made at deuteron energies of 7.0 MeV and 11.4 MeV of the following quantities: polarization of the outgoing neutrons for unpolarized deuterons incident; polarization of the outgoing neutrons for polarized deuterons incident; and vector and tensor analyzing powers for polarized deuterons. The derivative rule of Rodberg is found to give a good account of d-t and n-He elastic scattering polarizations and lends strong support to the argument for large spin-orbit effects in the T(d,n)He-4 reaction. DWBA calculations using optical potentials that qualitatively reproduce elastic channel data are presented. Author (NSA)

N71-29446# Argonne National Lab., Ill. Applied Physics Div.
ANALYSIS OF COMPTON CONTINUUM MEASUREMENTS
R. Gold and I. K. Olson Feb. 1970 84 p refs
(Contract W-31-109-eng-38)
(ANL-7611) Avail: NTIS

Five computer programs, COMPSCAT, FEND, GABCO, DOSE, and COMPLOT, were developed and used for the analysis and subsequent reduction of measured energy distributions of Compton recoil electrons to continuous gamma spectra. In addition to detailed descriptions of these computer programs, the relations among these codes are stressed. The manner in which these programs function is illustrated by tracing a sample measurement through a complete cycle of the data-reduction process. Author (NSA)

N71-29473# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
EXPERIMENTS WITH ULTRACOLD NEUTRONS
L. V. Groshev, V. N. Dvoretskii, A. M. Demidov, V. I. Lushchikov, Yu. N. Panin et al 1970 16 p refs In RUSSIAN
(JINR-P3-5392) Avail: AEC Depository Libraries

A possibility for extraction of ultracold neutrons from a stationary reactor is shown. The spectra and diffusion length of ultracold neutrons are given. The results of preliminary measurements of neutron storage time in closed containers are presented. Author (NSA)

N71-29476# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
CONTRIBUTION OF THE EXCHANGE MECHANISM IN THE BACKWARD SCATTERING OF PROTONS ON LIGHT NUCLEI AND d + He 4 YIELDS He 3 + H3 REACTION
B. Z. Kopeliovich and I. K. Potashnikova 1970 16 p refs In RUSSIAN
(JINR-P2-5496) Avail: AEC Depository Libraries

The role of the exchange mechanism in the backward scattering of protons on light nuclei is discussed. The results of calculations for dependence of P - He-4 backward scattering cross section on proton kinetic energy T rho in laboratory system are presented. Since numerical agreement obtained for He-4 does not prove the dominance of the pole diamgrams, other confirmations are needed. Such confirmation would be, of course, the existence of dips in the energy dependence of p - He-4 and p - He-3 backward cross sections. From isotopic invariance it follows also that for the pole

diagrams, cross sections of p - He-3 backward scattering and the p + H-3 yields n + He-3 charge exchange reaction must be equal, but the p - H-3 backward scattering should be suppressed. It is desirable also to measure the polarization effects in the above reactions. Such effects should be suppressed in the case of dominance of one of the diagrams. The cross section for d + He-4 yields H-3 + He-3 reaction was calculated under the same assumptions. This reaction is interesting from the point of view of isotopic invariance. Author (NSA)

N71-29477# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.

STUDY OF REACTIONS BE 9 + t BELOW THE COULOMB BARRIER

Jean-Pierre Ulpat, Jacqueline Pornet, and Francoise Bertrand Jan. 1971 25 p refs In FRENCH

(CEA-R-4117) Avail: AEC Depository Libraries

Angular distributions and absolute cross sections were measured for the reactions Be-8(t,alpha sub 0)Li and Be-8(t,alpha sub 1)Li* using several values of triton energy in the 0.3 to 1 MeV range. A single nuclear transfer mechanism was assumed, and the D.W.B.A. code Julie fit the data. NSA

N71-29478# Oak Ridge National Lab., Tenn. Isotopes Information Center.

PERMUTED ISOTOPES AND RADIATION TECHNOLOGY INDEXES (PIRTI), 1962 - 1969, VOLUMES 1 - 7

Helen P. Raaen, P. S. Baker, Robert H. Lafferty, Jr., Ann S. Klein, and Linda P. Helton, eds. Mar. 1971 282 p refs

(Contract W-7405-eng-26)

(ORNL-2C-31-Vols-1-7) Avail: NTIS

The index is cumulative and is prepared to facilitate retrieval of information from Isotopes and Radiation Technology. Information is included on keyword index, bibliographic index, personal author index, corporate authors, and suggestions concerning use of the index. NSA

N71-29514# Illinois Univ., Urbana. Noyes Chemical Lab.

THE Z DEPENDENCE OF COUPLING CONSTANTS BETWEEN DIRECTLY BONDED NUCLEI: THE VALUE OF J(73-Ge-13C)

Don K. Dalling and H. S. Gutowsky 12 Apr. 1971 33 p refs

(Contract N00014-66-C-0010)

(AD-721717; TR-23) Avail: NTIS CSCL 7/4

The Fermi contact contribution to the reduced, nuclear spin-spin coupling constant of directly bonded atoms, K sub XN, has been studied by determining the Z dependence of the electron spin density at the nuclei of the isolated atoms. Two methods of calculating the spin density from atomic spectra were tested and the results are employed to determine K sub XN. It is concluded that K sub XN for series of isoelectronic, isostructural compounds varies as Z (sub X) n, where n is a relativistic correction which ranges from 1.0 to about 2.5 depending on Z sub X. The theoretical results are compared with experimental data for symmetrical compounds with bonds of the type XF, XH, and XC, and apparent core polarization contributions to K sub XN are noted. The directly bonded coupling constant between 73Ge and 13C has been measured in tetramethylgermane; it is 18.7 0.9 Hz. Author (GRA)

N71-29518# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

EXTERNAL INJECTION AND ACCELERATION OF THE BEAM TO THE FINAL RADIUS IN THE ELECTRON MODEL OF THE RING CYCLOTRON WITH STRONG FOCUSING

A. A. Glazov, V. V. Kol'ga, D. L. Novikov, and L. M. Onischenko 1970 19 p refs In RUSSIAN

(JINR-P9-5433) Avail: AEC Depository Libraries

The results of experimental investigations of the external injection of the beam into the electron model of the ring cyclotron and its acceleration to the final radius are presented. Improvements resulting from the investigation of the beam in the electron model have allowed the electron beam with an average current of about 600 microamp to be accelerated to the final radius. Author (NSA)

N71-29526# Scientific Translation Service, Ann Arbor, Mich.

INTRANUCLEAR CASCADES WITH ALLOWANCE FOR ALPHA-CLUSTERS

V. S. Barashenkov et al [1971] 7 p refs Transl. into ENGLISH from Acta Phys. Pol. (Poland), no. B1, 1970 p 65-70 Sponsored by AEC Prepared for ORNL

(ORNL-tr-2452) Avail: NTIS

The model of intranuclear cascades in a light nucleus with allowance for direct interactions of cascade protons with alpha clusters is considered using the inelastic interactions of 660-MeV protons with carbon nuclei as an example. At this stage limitation is made to a consideration of a model with a sharp nuclear boundary and uniform distribution of alpha clusters. The results of calculation of the angular and energy distributions of secondary protons, the distribution of excitation energies and of the yield of residual nuclei are slightly dependent on the parameters of the cluster model. The experiments and calculation for the alpha particles produced are in agreement only when the alpha clusters are taken into account. The best agreement with the experiment is reached if the probability of coagulation of nucleons into alpha clusters is about 20%. Author (NSA)

N71-29530# Japan Atomic Energy Research Inst., Tokyo.

CLUP 77: A FORTRAN PROGRAM OF COLLISION PROBABILITIES FOR SQUARE CLUSTERED ASSEMBLY

Keiichiro Tsuchihashi Jul. 1970 21 p In JAPANESE

(JAERI-1196) Avail: AEC Depository Libraries

The collision probabilities in a multi-region (< or = to 120) square assembly consisting of clustered rods of infinite height are calculated by a Fortran program CLUP 77 by a numerical double integration. The assembly is divided into a number of pillars with a rectangular cross section. A rectangular pillar may contain a nest of concentric annuli of different materials. The assembly must be symmetric both bilaterally and diagonally. A region consists of one or several pillars (with the shapes retangular, annular, etc.). The outer boundary of the assembly may be reflective or vacuum. Therefore an array of fuel rods, a cruciform control rod and a poison curtain in the assembly can be treated without smearing. When and only when one group calculation with a fixed source is required, the flux distribution is calculated by the iterative technique, and the reaction rates (absorption, absorption + leakage, collision) at each region and by each material and averaged cross sections are obtained. Author (NSA)

N71-29547# Washington Univ., Seattle. Dept. of Physics.

REGGE BEHAVIOR IN INCLUSIVE EXPERIMENTS

R. D. Peccei and A. Pignotti Feb. 1971 13 p refs Supported by AEC

(RLO-1388-601) Avail: NTIS

The Regge prediction for the behavior of inclusive cross sections near the kinematic boundary is discussed and compared with a recent conjecture. Some existing experimental data are analyzed and in particular, no evidence is found yet for diffraction dissociation into high masses (three Pomeron coupling). Author (NSA)

N71-29625# Oak Ridge National Lab., Tenn. Electronuclear Div.

TRENDS IN THE UNITED STATES FOR THE ACCELERATION OF HEAVY IONS

Robert S. Livingston and John A. Martin Mar. 1971 27 p refs

Presented at the Intern. Conf. on Heavy Ion Phys., Dubna, USSR, 11–17 Feb. 1971 Revised
(Contract W-7405-eng-26)
(ORNL-TM-3332-Rev; CONF-710209-2-Rev) Avail: NTIS

The performance of US accelerators for heavy ions is compared. The review includes existing accelerators, those under construction, and proposed accelerators. The desirable characteristics for a forefront heavy ion accelerator are listed. A description of the super-HILAC conversion serves to highlight the discussion of progress in the United States. As an example of the possibilities and limitations of current isochronous cyclotrons, the heavy ion acceleration capabilities and use of the Oak Ridge Isochronous Cyclotron are discussed. The report briefly reviews the possibilities of new concepts including superconducting linear accelerators and supervoltage tandems. The performance characteristics of major existing and proposed European accelerators are compared. Author (NSA)

N71-29631# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
METHOD TO DETERMINE FAST AND THERMAL NEUTRON FLUXES BY FOIL ACTIVATION ANALYSIS
Richard L. Murri and Dennis G. Vasilik 12 Mar. 1971 12 p refs
(Contract AT(29-1)-1106)
(RFP-1466) Avail: NTIS

A general method of foil activation analysis for measuring neutron fluxes is presented with a complete derivation of the mathematical expressions used. Although the method is not new, descriptions of the theory, experimental procedures, and the constants and parameters used in the analysis are widely scattered in the literature. This report compiles this information for easy reference. Detailed examples using copper foil activation for measuring fast neutron fluxes and indium foil activation measuring thermal neutron fluxes are given. Author (NSA)

N71-29632# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
REVIEW OF GAMMA-RAY TRANSITIONS FROM keV NEUTRON CAPTURE
B. J. Allen Sep. 1970 36 p refs Presented at the Ann. Meeting of the Am. Phys. Soc., Chicago, Jan. 1970
(AAEC/TM-565; Conf-700102-4) Avail: AEC Depository Libraries

The study of gamma rays from neutron capture in the keV energy region provides information on the properties of individual resonances with keV spacing in light nuclei or nuclei near closed shells, and on the average behavior of resonances in heavy nuclei. The effects of p-and d-wave capture can be investigated across the periodic table, as can the neutron capture mechanisms. A variety of techniques are applicable in this energy range and these, with the results obtained, are reviewed. Author (NSA)

N71-29651# Maryland Univ., College Park. Dept. of Chemistry.
RESEARCH IN NUCLEAR CHEMISTRY Progress Report, 1970
V. E. Viola, Jr. Nov. 1970 25 p refs
(Contract AT(40-1)-3783)
(MNC-3783-9) Avail: NTIS

The initiation of experimental activities and continued development of equipment are reported. Brief descriptions are given on the following investigations: fission of U-238, B-11, C-12, N-14, and F-19; nuclear levels in Lu-177, Lu-175, and Hf-178; prediction of heavy element nuclidic masses and lifetimes, and use of position sensitive detectors; 30-inch diameter scattering chamber and beam line; multiparameter data acquisition program; alpha decay in Os isotopes; and alpha radioactivity in air samples. N.E.N.

N71-29652# Department of Atomic Energy, Bombay (India).
REPORTS ON BHABHA ATOMIC RESEARCH CENTRE, TATA INSTITUTE OF FUNDAMENTAL RESEARCH, PHYSICAL RESEARCH LABORATORY, SAHA INSTITUTE OF NUCLEAR PHYSICS, TATA MEMORIAL CENTRE, INDIAN SPACE RESEARCH ORGANIZATION, ATOMIC MINERAL DIVISION, INDUSTRIAL OPERATIONS, ATOMIC POWER AND INTERNATION RELATIONS Annual Report, 1969–1970
1970 88 p
(DAE-AR-70) Avail: AEC Depository Libraries

Atomic energy research and technological developments are described. The areas investigated include the following: atomic power stations, nuclear research, preparation of radioisotopes and labelled compounds, radiopharmaceuticals, plant breeding programs, cellular metabolism and development of food irradiation procedures, medical uses of radioisotopes, nuclear and nonnuclear electronic instrumentation, production of materials for nuclear reactors, space research projects, power reactor fuel reprocessing, fuel element development, radiation and solid state chemistry, measurement of fallout from Chinese nuclear explosions and French tests, radiation safety program, on-line data processor, balloon sounding, dating of archeological sites existing around 1300 and 2700 BC, steerable radio telescope, and mining atomic minerals. N.E.N.

N71-29655# Gulf Radiation Technology, San Diego, Calif.
APPLICATION OF PHOTOINDUCED REACTIONS TO NUCLEAR MATERIALS SAFEGUARDS PROBLEMS Quarterly Progress Report, 1 Oct.–31 Dec. 1970
R. L. Bramblett, D. G. Costello, R. O. Ginaven, J. I. McMillan, D. E. Rundquist et al 10 Feb. 1971 45 p refs
(Contract AT(04-3)-167)
(GULF-RT-10511) Avail: NTIS

The development and application of techniques and equipment for the nondestructive measurement of nuclear materials in the various forms that can be encountered in the fuel cycle are described. The major emphasis was on field testing the Gulf Atomic Mobile Assay System (GAMAS). Some modifications were made to make the trailer more roadworthy and to allow GAMAS to travel in all states without a special permit. These modifications and other improvements are discussed. GAMAS was used to assay 5 gallon drums containing silicon carbide with enriched uranium. The results and a brief discussion of these measurements are given. The general details of the present software package for the Hewlett Packard 2116 B computer which is used to accumulate and analyze data are discussed. Present experience and future possibilities indicate that the reliability and practicability of a mobile assay laboratory will depend to a large extent on the speed and automatic control that can be gained by the proper utilization of a small computer. The major features of the Isotopic Source Assay System are discussed along with the present status of ISAS 3. Dissert. Abstr.

N71-29656 Michigan Univ., Ann Arbor.
THE NUCLEAR STRUCTURE OF Ce-140, La-139, AND Ba-138 DETERMINED WITH (d,He-3) AND (He-3,d) TRANSFER REACTIONS
Lawrence William Borgman (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms Order No. 70-14479

The nuclear structure of three nuclei, each having a closed shell of eighty two neutrons, were studied using the proton transfer reactions La-139(He-3,d)Ce-140, Ce-140(d,He-3)La-139 and La-139(d,He-3)Ba-138. Excitation spectra were measured up to 4.36 Mev in Ce-140, to 1.95 MeV in La-139, and to 3.05 Mev in Ba-138. Angular momentum transfer were determined from analysis of the characteristic angular distributions with distorted wave calculations for levels observed in each of these nuclei. Shell model calculations for each of the nuclei studied were made in a generalized seniority basis space. In these calculations a combination of the surface delta interaction and the generalized pairing interactions were used as residual interactions. There was good agreement between the measured and calculated spectra for the nuclei studied. Dissert. Abstr.

N71-29712# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

REGULARIZING PROPERTIES OF SUPERPROPAGATORS

M. K. Volkov 1971 21 p refs In RUSSIAN

(JINR-P2-5569) Avail: AEC Depository Libraries

Superpropagators are used in nonrenormalizable theories describing both localizable interactions (where it is possible to satisfy the microcausality principle) and non-localizable ones (where only the macrocausality principle can be satisfied). Author (NSA)

N71-29719# Hamburg Univ. (West Germany).

THE BREAKDOWN DEVELOPMENT IN N2 AND H2 CAUSED BY SPACE CHARGE CASCADE MECHANISM [DIE ENTWICKLUNG ZUM DURCHSCCHLAG IN N2 UND H2 NACH DEM GENERATIONEN-MECHANISMUS UNTER DEM EINFLUSS DER RAUMLADUNG]

Hellmut Hessenauer (Ph.D. Thesis) 1970 48 p refs In GERMAN

Avail: NTIS

The effect of a space charge on the gas discharge development time is studied by considering electron cascades triggered through shock ionization. Described is mainly the photon excitation of molecules and their continuous contributions of electrons to the charge. A numerical solution to the problem is obtained by using a system of continuity equations that contain time and position dependent ionization coefficients as defined by the space charge, to describe the developing breakdown from beginning to the stage of rapid current increase and the recoiling ionization front. Transl. by G.G.

N71-29749*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTER-PLOTTER STUDIES OF VIBRATIONAL EFFECTS IN ION-DIPOLE COLLISIONS: CLASSICAL TUNNELING

John V. Dugan, Jr. and Bruce Canright, Jr. Washington Jul. 1971 22 p refs

(NASA-TN-D-6407; E-6260) Avail: NTIS CSCL 20H

Computer-plotter studies of ion-dipole collisions are extended to calculating vibrational effects on capture cross sections and formation of ion-molecule complexes. Two different dipole moment variations are assumed about the equilibrium separator of the oscillator. The capture cross section is sensitive to the oscillator model. However, the nature of the ion molecule complex is relatively insensitive to the oscillator model. In certain collisions, the oscillator becomes constrained so it cannot relax to its equilibrium separation (classical tunneling). The conditions for tunneling are discussed in terms of collision parameters. Author

N71-29750 North Dakota State Univ., Fargo.

THE INTERMOLECULAR POTENTIAL AND THERMAL ELASTIC SCATTERING

Yeu Tsang Nee (Ph.D. Thesis) 1969 114 p

Avail: Univ. Microfilms Order No. 70-14704

Modifications of the square well form were employed to test which region of the Lennard-Jones potential possesses a significant influence on the total cross section data. None of the modifications raised the Q(v) curve in the region of high velocity or lowered the calculated points in the region of low velocity whole. Attention was focused upon the Morse potential function containing three parameters. Variation of the third parameter alone produced the opposite sign of deviation for the entire Q(v) curve. This illustrated that the Lennard-Jones and Morse functions each possesses an opposite effect of lifting and dropping one end of a curved lever arm which has its fulcrum located just about at the middle of the Q(v) versus v curve. Functional iteration of all three parameters in the pure Morse potential function reduced the sum of squared error by eighty percent. Dissert. Abstr.

N71-29758# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.

REFLECTION OF HIGH ENERGY IONS FROM ATOMIC AND IONIC CHAINS [REFLEXION VON ENERGIEREICHEN IONEN AN ATOM-UND IONENKETTEN]

Constantin Varelas (Ph.D. Thesis) 1969 81 p refs In GERMAN

Avail: NTIS

Computer calculations determine the optimal angle for the proton and alpha particle channeling effect as well as the smallest distance between the channeling paths of the atomic- and ionic-chains in relation to particle energies and collision partner properties. Comparison with approximative formulas for determining critical angles shows that numerical calculations agree for low energy particles up to 10%; higher energy particle calculations of critical angles proved about a factor of 2 lower than those obtained by Lindhard approximations. Transl. by G.G.

N71-29760 Wisconsin Univ., Madison

QUARK SEARCH USING A 1 MV MASS SEPARATOR AND PULSE HEIGHT ANALYSIS

Kurt Efraim Nielsen (Ph.D. Thesis) 1970 225 p

Avail: Univ. Microfilms Order No. 70-8321

A search was made for stable particles of fractional charge + or − 1/3 e and + or − 2/3 e from which it was suggested that all baryons and mesons are constructed. A description is given of the methods used to detect quarks existing either as new chemical elements or in combination with the known elements. A mass separator was developed to simultaneously measure the mass and energy of ions present in various beams accelerated by an electrostatic generator operating at 1 MV. Charge was measured by means of energy determination using a surface barrier detector and pulse height analysis. Helium, hydrogen, nitrogen, oxygen, air, and limestone were examined. Data are exhibited and, from the null results, upper limits were determined for the concentration of quarks in the samples studied. These limits were on the order of 3 × 10 to the minus 14 power quarks/molecule. Dissert. Abstr.

N71-29765*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STUDY OF THE (ALPHA,t) REACTION ON ZIRCONIUM-90, MOLYBDENUM-92, AND MOLYBDENUM-96 AT 41.5 MeV

Joseph R. Priest (Miami Univ., Oxford, Ohio), John S. Vincent, and Glenn M. Julian (Miami Univ., Oxford, Ohio) Washington Jul. 1971 15 p refs

(NASA-TN-D-6413; E-6265) Avail: NTIS CSCL 20H

Angular distributions for the (alpha,t) reactions on Zr-90, Mo-92, and Mo-96 leading to the ground states of Nb-91, Tc-93, and Tc-97 were measured from 15 deg to 60 deg for an alpha particle energy of 41.5 MeV. The distorted wave Born approximation calculation for the stripping of an l = 4 proton provides an adequate description of the angular distributions. The spectroscopic strengths agree favorably with those deduced from a similar study using the (He-3,d) reaction. These results are consistent with a model which envisions the ground states of Nb-91, Tc-93, and Tc-97 as a 1g sub 9/2 proton coupled to a 0(+) core. Author

N71-29766# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

FORMAL EXPRESSIONS AND RESTRICTED DISTORTED WAVE FORMULAE FOR RIGID ROTOR CROSS SECTIONS

Lawrence W. Hunter 30 Oct. 1970 107 p refs

(Grant NSF GP-12832)

(PB-197481; WIS-TCI-422) Avail: NTIS CSCL 07D

Expressions are developed for three types of cross sections associated with collisions of rigid rotors. Author (GRA)

N71-29778*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEPENDENCE OF INTEGRATED CROSS SECTIONS ON THE ROTATIONAL STATES OF SODIUM-23 IN THE REACTION MAGNESIUM-25 (d, alpha) SODIUM-23 AT 20.9 MeV

Joseph R. Priest (Miami Univ., Oxford, Ohio) Washington Jul. 1971 14 p refs
(NASA-TN-D-6412; E-6264) Avail: NTIS CSCL 20H

The integrated cross sections for production of K = 3/2 states in the Mg-25(d,alpha)Na-23 reaction which obey a linear relation of the form sigma = a(2I + 1) - b were analyzed. A comparison is presented of the results with similar data from the Al-27(d,alpha)Mg-25 reaction which suggests that the negative intercept is a consequence of band mixing in the states of Na-23. Author

N71-29780 Michigan Univ., Ann Arbor.
NEUTRON-PROTON, NEUTRON-DEUTERON, AND NEUTRON-NUCLEUS TOTAL CROSS SECTIONS AT 4.0 GeV/c AND 5.7 GeV/c
Everette Francis Parker (Ph.D. Thesis) 1969 77 p
Avail: Univ. Microfilms Order No. 70-14612

Neutron total cross sections were measured for H2, D2, He, Be, C, Al, Fe, Cu, Cd, W, Pb, and U at 5.7 + or − 0.6 GeV/c incident momentum. The hydrogen and deuterium cross sections were also measured at 4.0 + or − 0.6 GeV/c. The deuteron screening factor was determined from the hydrogen and deuterium cross sections. The resulting values are compared with the previous experimental evaluations and theoretical predictions. The total cross section vs atomic weight data were fitted to an optical model. Dissert. Abstr.

N71-29785 Wisconsin Univ., Madison.
PRODUCTION AND LOSS OF FAST METASTABLE HELIUM ATOMS DURING CHARGE CHANGING COLLISIONS WITH PERMANENT GASES
Richard Ernest Miers (Ph.D. Thesis) 1970 98 p
Avail: Univ. Microfilms Order No. 70-8317

The cross sections for production and destruction of fast neutral He atoms in the metastable triplet state in gas targets of Xe, Kr, H2, N2, A, Ne and He were measured for energies of the incident He(+) ion between 10 and 30 keV. A He(+) beam is passed through two targets. In the first target containing one of the permanent gases the He(+) beam is partially neutralized by charge exchange. The charged particles are deflected from the beam, and the neutral particles are allowed to pass into a second target containing Cs vapor. The intensity of the neutral He, He(+) and He(−) beams emerging from the Cs target is measured. By analyzing the fraction of neutral He atoms in the metastable triplet state emerging from the first target as a function of the density of the first target the cross sections for loss of fast He deg in the triplet metastable state are also determined. Dissert. Abstr.

N71-29787 Illinois Inst. of Tech., Chicago.
OPTIMAL MULTICONFIGURATIONAL WAVEFUNCTIONS FOR pi-ELECTRON SYSTEMS
San Y. Chu (Ph.D. Thesis) 1970 111 p
Avail: Univ. Microfilms Order No. 70-10142

The primary aim of this work was to transcend the configuration interaction approach to improving the Hartree-Fock representation of complex molecules. Hitherto only atoms and diatomic molecules have proven amendable to such extensions. Incidental to that aim was the introduction of the additional complication of a core potential operating on the electrons considered explicitly. This basic idea has numerous applications, however the particular vehicle selected was two pi-electron systems of low symmetry. The results are presented and compared by the three models: The Hartree-Fock (H.F.), the configuration interaction (C.I.) and the optimal multiconfiguration (O.M.C.). The correlation error inherent in the H.F. model can be taken care of by thirteen percent more in the O.M.C. model than in the C.I. model for the particular molecules studied. Dissert. Abstr.

N71-29790# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
FIELD ION MASS SPECTRA OF SELENIUM [FELDIONEN-MASSENSPEKTREN DES SELENS]
Horst Saure (Ph.D. Thesis) 1969 101 p refs In GERMAN
Avail: NTIS

Mass spectrometric analysis of field-ionized selenium vapor projects more the behavior of polymeric molecules than that of a metallic crystal. The selenium vapor consists of differential sized particles that possess the ability to change with each other without loosing their chemical properties. Vapor condensation under a high electrical field produces whiskers of triagonal modifications. Transl. by G.G.

N71-29791# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
LEVEL CROSSING AND DOUBLE RESONANCE STUDIES ON THE EXCITED LEVELS 5d6s6p(1D) 2D3/2 AND 5p6s6p(1D) 2F5/2 FOR DETERMINING HYPERFINE STRUCTURE OF Lu-175 [LEVELCROSSING UND DOPPELRESONANZUTERSUCHUNGEN IN DEN ANGEREGTEN TERMEN 5d6s6p(1D) 2D3/2 UND 5d6s6p(1D) 2F5/2 ZUR BESTIMMUNG DER HYPERFEINSTRUKTUR VON Lu-175]
Lutz Goebel (Ph.D. Thesis) 1969 50 p refs In GERMAN
Avail: NTIS

The hyperfine structure of excited terms in the deformed Lu-175 nucleus is studied by double resonance spectra and the levelcrossing method using dipole radiation of high oscillating frequency. Resonance spectra of the atomic Lu beam provided the hyperfine structure constants of the magnetic dipole exchange effect and the electrical quadrupole exchange effect for the excited terms 5d6s(1D)2D3/2 and 5d6s(1D)2F5/2, both of which are connected to the ground level 5d6s2 2D3/2 through the wavelines 4518.57 A and 3567.84 A. Transl. by G.G.

N71-29793 Illinois Univ., Urbana.
ON SHELL CURRENT ALGEBRA AND THE RADIATIVE LEPTONIC DECAYS OF PIONS AND KAONS
Neal Jay Carron (Ph.D. Thesis) 1969 117 p
Avail: Univ. Microfilms Order No. 70-13266

The hard meson method of Schnitzer and Weinberg is used to study the radiative leptonic decays of pion and K. The original formalism for SU(2) is generalized to include the case of strangeness changing axial vector currents and the isoscalar part of the electromagnetic current. This method and dispersion relations are used to determine the form factors for the decays. It is shown that in the pole dominance approximation, the relevant form factor in the axial vector amplitude, cannot be unsubtracted. Possible alterations of results arising from relaxing a smoothness approximation are estimated to be small. Several symmetry breaking schemes for the evaluation of necessary coupling constants are discussed. The branching ratio for K(+) yields gamma e Nu is calculated to be approximately 2 × 10 to the minus 5th power for interesting structure dependent decays. Finally possible effects of electromagnetic violatons of time reversal invariance in the decay is investigated. Dissert. Abstr.

N71-29799 Wisconsin Univ., Madison.
NONADIABATIC PARTICLE MOTION IN LINEAR AND TOROIDAL MULTIPOLE FIELDS
James Edward Howard (Ph.D. Thesis) 1969 131 p
Avail: Univ. Microfilms Order No. 70-3561

The circumstances under which the second order term in the magnetic moment series is significant are investigated in detail. A formula is derived which correctly predicts the dependence of magnetic moment change on the parameters defining the particle orbit, and which agrees to about 35% with data obtained from computed orbits. Various schemes are presented whereby these results may be extended to toroidal multipoles and to multipole devices with irregular conducting walls, with particular attention

given to the Wisconsin toroidal octupole. An attempt is made to relate the jumps in magnetic moment to particle trapping in multipole fields. If the successive changes in magnetic moment are random, then standard statistical methods may be employed to estimate the lifetime of trapped particles. However, computer experiments in which a particle was followed for many reflections seem to show that ther may be correlations in magnetic moment from pass to pass. Dissert. Abstr.

N71-29802 Oklahoma Univ., Norman.
THE INTERACTIONS OF 16.2 BeV NEGATIVE PIONS WITH EMULSION NUCLEI
Patrick Daniel O'Reilly (Ph.D. Thesis) 1970 195 p
Avail: Univ. Microfilms Order No. 70-14423

A group of 298 pion-nucleus interactions was randomly selected for analysis from the events which were found in scanning the processed plates. The mean free path for the interaction of a pion with an average emulsion nucleus was determined. Calculations were made to determine the screening effect of the surrounding nucleons on the interaction cross section. Out of a total of 1609 secondary pions, the momenta of 736 were measured using multiple Coulomb scattering techniques. The angle of emission of all the secondary pions were measured. Using standard selection criteria, the events were divided according to the size of the target nucleus involved in the interaction. The angular distributions, transverse momentum distributions, average transverse momenta, and inelastically for pion production were determined. The results were compared with various theoretical models and previous experimental results of high energy particle-nucleus interactions. Dissert. Abstr.

N71-29836# Atomic Energy Commission, Washington, D.C. Div. of Isotopes Development.
[ISOTOPE RESEARCH AND DEVELOPMENT PROJECTS, 1970] Progress Reports
Feb. 1971 161 p refs
(TID-4066) Avail: NTIS

Summaries of current research and development projects are reported. The summaries are reported under the following major technical program areas and objectives: radioisotope production and materials, thermal applications, environmental and ocean sciences, radiation analysis and control, process radiation, and radiation preservation of foods. NSA

N71-29839# Wisconsin Univ., Stoughton. Physical Sciences Lab.
OPERATION OF THE ACCELERATOR STORAGE RING TO PROVIDE ULTRAVIOLET RADIATION Interim Report, 1 Dec. 1969 - 30 Nov. 1970
Ednor M. Rowe 30 Nov. 1970 76 p ref
(Contract F44620-70-C-0029)
(AD-722472; AFOSR-71-0794TR) Avail: NTIS CSCL 20/7

It was proposed to operate the electron storage ring as the source of ultraviolet radiation for the performance of experiments in solid state, atomic, and surface physics. In addition to operating the storage ring as a source of ultraviolet radiation for physical and chemical experimentation, it was proposed to set up a permanent experimental station at the north port of the storage ring. This was to be accomplished through the acquisition of a normal incidence monochromator, experimental chamber and a focusing system. The installation of a parallel beam line at the west port was planned as a means for accommodating more experiments at the ring. A study of the wave shifter was to be undertaken in order to determine the feasibility of enriching the synchrotron radiation spectrum in the shorter wavelength range through the use of orbit perturbing magnets. In addition, several improvements in the storage ring and the injector synchrotron were planned. These included the completion of a high power RF supply, and the replacement of several trimmer coil power supplies on the injector synchrotron and beam transport line. This report details the progress made on these projects. Author (GRA)

N71-29842# New York Univ., N.Y. Dept. of Electrical Engineering.
SCATTERING OF ELECTROMAGNETIC RADIATION BY HYDRODYNAMICALLY TURBULENT SYSTEMS
David Attwood Mar. 1971 67 p refs
(Contract N00014-67-A-0467-0018)
(AD-722323; TR-402-7) Avail: NTIS CSCL 20/14

Electromagnetic scattering by turbulent systems is reviewed via an operator formalism with emphasis on possible diagnostic schemes. It is pointed out that in principal both spatial and temporal behavior of fluctuations (wavevector and frequency) can be determined. Noting that in Born approximation the calculation of total scattering to all directions is independent of orderliness of array, absolute cross-sections are obtained. Using a spectral function thought to bear some relevance to hydrodynamic turbulence, absolute differential cross-sections are obtained for gases (argon) and plasmas (gas seeded with a discharge plasma). Numerical results are presented for optical, infrared and microwave scattering. Possible detection schemes are discussed. Author (GRA)

N71-29845# Maryland Univ., College Park. Dept. of Physics and Astronomy.
AN ANALYSIS OF THE Y KAON ANTIKAON AND XI(0) HYPERON KAON(+) PION(-) THREE BODY FINAL STATES FROM KAON(-) PROTON INTERACTIONS AT 2.9 GeV/c
Alan Roy Stottlemyer (Ph.D. Thesis) Feb. 1971 99 p refs
(ORO-2504-170; TR-71-077) Avail: NTIS

The three body final states Lambda(0) hyperon kaon antikaon, Sigma hyperon Kaon antikaon, and Xi(0) hyperon kaon(+) pion(-) produced by kaon(-) proton interactions were analyzed at a kaon(-) beam momentum of 2.9 GeV/c. The primary purpose of the experiment is a study of strageness -2 baryon states at a single momentum. Evidence is presented for the existence of at least one such resonance with a mass of about 1860 MeV. There is a large sample of phi-mesons, produced in both the Lambda(0) and hyperon phi-meson final states. The mass and width of the phi-mesons have been measured, and the results are compatible with existing data. The Sigma(0) and hyperon phi-meson production to distributions are given, illustrating a possible difference in the production mechanisms for the two final states. The production cross sections are determined for all reactions presented. The effective exposure is about 30 events/microbarn for the Lambda(0) kaon(0) antikaon (0), Sigma(0) kaon(-), and Sigma(-) hyperon kaon(+) antikaon(0) final states, and about 5 events/microbarn for the Lambda(0) hyperon kaon(+) kaon(-), Sigma(0) hyperon kaon(+) kaon(-), and Xi hyperon kaon(+) pion(-) final states. Author (NSA)

N71-29864# Harvard School of Public Health, Boston, Mass.
DETERMINATION OF THE INTERPARTICLE VOID VOLUME IN PACKED GRANULAR BEDS FROM AEROSOL BREAKTHROUGH CURVES
Dwight W. Underhill, Parker C. Reist, and Ronald Hurley *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 635-652 ref (See N71-29851 17-13)
(Contract AT(30-1)-841; Grant AP-00003-09)
Avail: NTIS HC $6.00/MF $0.95

It is shown that the interparticle porosity of a packed bed may be determined accurately from the breakthrough curve of a flowing stream of aerosol using the statistical moments of the aerosol breakthrough curve. From the zeroth moment, a rate constant is found which describes the rate of aerosol removal by collisions between the aerosol particles and the granules in the packed bed. The analysis proceeds by using this collision rate factor to remove the effect of aerosol loss from the breakthrough curve data. From the normalized breakthrough curves obtained, the first and second statistical moments are calculated. The interparticle porosity is determined directly from the first statistical moment. The second statistical moment, used in combination with the first statistical moment, determines the effective interparticle diffusion coefficient.

Breakthrough curves obtained from beds of Raschig rings and Berl saddles were analyzed and compared to results determined from conventional porosity measurement techniques. Author (NSA)

N71-29899*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RESONANCE QUASI-PROJECTION OPERATORS: CALCULATION OF AUTOIONIZATION STATES OF He(−)

A. Temkin, A. K. Bhatia, and J. N. Bardsley June 1971 30 p refs Submitted for publication

(NASA-TM-X-65599; X-645-71-244) Avail: NTIS CSCL 20H

A method is presented to remedy the defects of the projection operator technique for calculating electron resonances in scattering from many electron targets. Specifically it is shown that if the projection operator (i.e. idempotent) Q is replaced by a quasi-projection operator Q such that lim Q psi = 0 as any r sub i approaches infinity then the spectrum of QHQ is discrete, and can be made to be in essentially a unique correspondence with resonance energies. Relaxation of the idempotency requirement allows a definition of two forms of the Q operator. The simpler of the two forms is tested on e-H and e-He(+) systems; the two lowest resonant energies differ by less than 0.01 eV from rigorous QHQ results. For many-electron targets it is further argued that replacement of the exact target eigenfunction phi sub 0 by reasonable approximations phi sub 0 in constructing Q will affect neither the discreteness of the spectrum QHQ nor the proximity of its eigenvalues to the resonant energies. Calculations of He(−) using two different (open and closed shell) phi sub 0's and an angle independent total wave function (phi) are found to differ by 0.01 eV. The open shell ground state was used with a configuration interaction phi with up to 40 configurations. No other resonances are found below the first excited (23S) target threshold. Author

N71-30004# Oak Ridge National Lab., Tenn.

MULTIPLE WINDOW SPECTROMETRY FOR Ga 67

D. A. Ross, W. J. McClain, J. K. East, and P. R. Bell Mar. 1971 14 p refs

(Contract W-7405-eng-26)

(ORNL-TM-3260) Avail: NTIS

The element gallium has been shown to concentrate favorably in a number of malignant human and animal tumors; and its importance in the scanning field is, therefore, obvious. From the standpoint of favorable half-life and tolerable radiation hazard, Ga-67 is the isotope of choice. This nuclide, however, presents problems to the detecting instruments, since it emits four main gamma lines, of which the most prominent, at 93 keV, is subject to severe scattering and interference from those above it. Successively higher-energy photons have decreasing interference but are less and less intense. When this nuclide is used, therefore, it is especially important to choose spectrometer settings with care, so that misinformation contributed by scattered photons will be kept to a minimum. The relative merits of various energy-band arrangements are discussed; these include some that bracket more than one spectral peak and others in which each peak has a spectrometer window of its own. Author (NSA)

N71-30005# Stockholm Univ. (Sweden). Inst. of Physics

BUBBLE CHAMBER EXPERIMENTS ON 10 AND 19 GeV/c PROTON-PROTON INTERACTIONS

Sven-Olof Holmgren Nov. 1970 74 p refs

(USIP-70-8) Avail: AEC Depository Libraries

An analysis of proton−proton interactions at 10 GeV/c and 19 GeV/c based on experiments in hydrogen bubble chambers is presented. Experimental details not published earlier are given. Physical results are summarized and for the 19 GeV/c experiment certain physical results are presented, which have not been published before. NSA

N71-30006# Rochester Univ., N.Y. Dept. of Physics and Astronomy.

REVIEW OF STRANGE MESONS

P. Slattery 1 Jan. 1971 53 p refs Presented at the Meeting of the Div. of Particles and Fields of the Am. Phys. Soc., Austin, Tex., 5−7 Nov. 1970

(Contract AT(30-1)-875)

(UR-875-332; Conf-701108-4) Avail: NTIS

The review of strange mesons covers the K pion pion/K pion decay branching ratio of the K*, evidence for the existence of possible substructure in the Q region, a review of the L region, and evidence for the existence of additional strange mesons. NSA

N71-30009# Oak Ridge National Lab., Tenn.

ENERGY CALIBRATION OF A PROTON RECOIL PROPORTIONAL COUNTER

G. L. Morgan, T. A. Love, E. A. Straker, R. M. Freestone, Jr., and C. E. Burgart 15 Mar. 1971 22 p refs

(ORNL-TM-3347) Avail: NTIS

Three methods for calibration of proton-recoil proportional counters were investigated. These are the N-14(n,p) C-14 reaction, an internally mounted alpha particle source, and observations of resonances in a neutron spectrum. Calibrations based on each method were compared and found to be consistent to within 2%. The variation of the gas amplification as a function of counter voltage was measured and was found to be in good agreement with the formula of Diethorn. Author (NSA)

N71-30010# California Univ., Livermore. Lawrence Radiation Lab.

INVESTIGATION OF THE POSSIBLE PRODUCTION OF A NANOSECOND PULSE OF 14-MeV NEUTRONS AND THE ACCELERATION OF IONS BY 7-kA PULSED ELECTRON BEAMS

J. P. Van Devender 16 Sep. 1970 14 p refs Sponsored by AEC

(UCRL-50935) Avail: NTIS

An attempt to produce a nanosecond burst of 14-MeV neutrons with the Td(d,n)He-4 reaction by accelerating deuterons with available 7-kA electron beams is reported. Acceleration of ions by high current, relativistic electron beams is investigated. Previous experimental and theoretical work is reviewed and compared. Arguments are presented to explain the experimental observations by a combination of electrostatic and magnetic acceleration mechanisms, with magnetic acceleration dominating if (Nu/gamma) < or = 1 and with electrostatic acceleration dominating if (Nu/gamma) >> 1. In experiments with two 7-kA electron beams of energies 600 keV and 2 MeV, no ion current greater than 0.01 A was observed. The negative results suggests a strong current dependence for the accelerating mechanism. Another experiment is proposed to utilize the dual mechanism theory by incorporating an external magnetic field and a moderate current electron beam to accelerate the ions. Author (NSA)

N71-30015# Clarkson Coll. of Technology, Potsdam, N.Y. Div. of Research.

STUDIES ON COLLOIDAL PARTICLES: SCAVENGING OF AEROSOL PARTICLES BY A FALLING MACROSCOPIC PARTICLE Progress Report, 1 Jan. −31 Dec. 1970

Milton Kerker Jan. 1971 53 p refs

(Contract AT(30-1)-3847)

(NYO-3847-2) Avail: NTIS

The collection efficiency of water droplets (0.71 to 2.54 mm radius) freely falling through a silver chloride aerosol consisting of a relatively uniform distribution of spheres with radii in the range of several tenths of a micron was studied. The droplets accelerated for a distance of 30 cm prior to entering the 130 cm aerosol chamber. The particle size distribution of the aerosol was determined by light scattering. The amount of AgCl scavenged by the droplet was analyzed by a very sensitive colorimetric technique. Collection

efficiencies measured were extremely low, dropping off sharply from a value of 3.1 × 0.0001 for a 2.54 mm droplet to a minimum of 6.3 × 0.000001 for a 0.94 mm droplet, and then it appeared to rise again for smaller droplets. There did not appear to be any significant trends with particle radius which ranged from 0.2 to 0.5 micrometers radius. In view of the large Reynolds numbers for these cases, the mechanism may involve the eddies in the wake of the droplet with enhanced collection on the backside.
Author (NSA)

N71-30016# California Univ., Livermore. Lawrence Radiation Lab.
ISOTOPIC ENRICHMENT BY ELECTROMIGRATION IN AQUEOUS SOLUTIONS
R. W. Ryon and D. G. Miller 10 Feb. 1971 25 p refs
(UCRL-51003) Avail: NTIS

Isotope separations were produced by electromigration in concentrated aqueous solutions of transition-metal halides in which a significant chemical exchange contribution to the overall separation process is expected. CuBr2, FeCl3, NiCl2, and NiBr2 were investigated. The heavy isotopes of copper and iron were enriched toward the cathode, whereas nickel showed the familiar heavy-isotope enrichment toward the anode. This exchange was exploited in aqueous electromigration separations. The CuBr2 process constant is about ten times greater than those obtained by previous workers; suggestions for further experimental improvement are made. It was concluded that this method is not likely to be useful for efficient large-scale separations, especially for heavy isotopes.
Author (NSA)

N71-30017# Columbia Univ., New York.
REMARKS ON THE ABSOLUTE VALUE OF DELTA I VECTOR EQUALS 1/2 RULE IN NONLEPTONIC WEAK DECAYS AND THE USE OF THE PHENOMENOLOGICAL LAGRANGIAN
T. D. Lee [1970] 62 p refs Lecture presented at Brookhaven Natl. Lab., Upton, N.Y., May 1970 Submitted for publication
Supported in part by AEC
(NYO-1932(2)-182) Avail: NTIS

It is shown that the validity of the usual soft-ion limit and the existence of an absolute value of Delta I vector = 1/2 rule for nonleptonic weak interactions are two independent assumptions. The alleged derivation of the absolute value of Delta I vector = 1/2 rule for nonleptonic K decays by using the soft-pion limit is, therefore, incorrect. As examples, several different phenomenological Lagrangian models for nonleptonic K decays are examined which illustrate the logical independence of these two assumptions. A speculative possibility concerning the origin of the absolute value of Delta I vector = 1/2 rule is analyzed.
Author (NSA)

N71-30019 Princeton Univ., N.J.
N + P YIELDS D + NEUTRAL PION: A TEST OF CHARGE INDEPENDENCE FROM THRESHOLD THROUGH RESONANCE PEAK
Ira Saul Hammerman (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms Order No. 70-14212

The differential and total cross sections for neutron + proton yields deuteron + neutral pion were measured for neutron energies from the threshold through the region of the first resonance peak. Total cross section data are presented in 10 MeV bins from 280 to 720 MeV. Differential cross section data are presented in 10 bins of 40 MeV from 280 to 680 MeV. A test was made of the predictions of charge independance and no evidence for a violation was seen. Neutrons of measured time of flight interacted in a liquid hydrogen target. Decay photons from the neutral pion were detected in a lead and aluminum plate spark chamber array. The deuteron track was measured in thin plate spark chambers and its momentum was analyzed by bending in a magnet. About two million pictures were taken. The results presented are based on 90,000 events.
Dissert. Abstr.

N71-30020# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
HALF-LIFE OF Pu 239 BY CALORIMETRY
Franklin L. Oetting [1970] 10 p refs
(Contract AT(29-1)-1106)
(RFP-1469) Avail: NTIS

The power output from two 1 kg samples of pure plutonium metal was determined by isothermal calorimetry. The major isotopic constituent in both samples was plutonium-239, accounting for 93% in the first sample and 97% in the second sample. After making power corrections for the remaining isotopes, the specific power output of plutonium-239 was found to be 1.931 + or − 0.000004 W/g. The power emitted by the two samples remained essentially constant (+ or − 0.1%) for a period of four months. Using the alpha zero energy for plutonium-239 of 5.1556 MeV and the recoil energy of 0.863 MeV, the alpha half-life of plutonium-239 was calculated to be 24,065 + or − 50 years. This is compared to the currently accepted value of 24,400 + or − 30 years as determined by absolute alpha (specific activity) low-geometry counting techniques.
Author (NSA)

N71-30022# Oak Ridge National Lab., Tenn.
INVESTIGATION OF BROADBAND CURRENT PREAMPLIFICATION FOR OBTAINING SIMULTANEOUS HIGH RESOLUTION ENERGY AND TIME INFORMATION FROM NUCLEAR RADIATION DETECTORS
Joe Kenneth Millard (Ph.D. Thesis - Tenn. Univ.) Mar. 1971 143 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3252) Avail: NTIS

Noise-performance limitations of existing broadband current-amplifying stages are first considered. A new broadband, shunt-feedback amplifier having a current gain equal to the ratio of an RC feedback impedance to an RC load impedance is then described. The value of the feedback resistance and capacitance can be made equal to that of conventional charge-sensitive preamplifiers. Basically, the configuration is similar to that of a charge-sensitive preamplifier; however, differentiation is performed by the feedback network to allow a broadband current transfer function. The stage has a large bandwidth capability with linearity and noise performance comparable to that of the conventional charge-sensitive configuration. Equations predicting the bandwidth, input and output impedances, and noise-performance are derived. A three-stage preamplifier having a current gain of 9000 was constructed to verify experimentally the predicted preamplifier performance characteristics.
NSA

N71-30038# Hamburg Univ. (West Germany).
STUDY OF SOME NUCLEAR REACTIONS THAT ARE TRIGGERED BY NEUTRONS FROM 12.65 MeV TO 18.25 MeV ENERGIES IN NaJ [UNTERSUCHUNG EINIGER KERNREAKTIONEN, DIE DURCH NEUTRONEN DES ENERGIEBEREICHS VON 12.65 MEV BIS 18.25 MEV IM NAJ AUSGELOESTWERDEN]
Bernd Aldefeld (Ph.D. Thesis) 1969 44 p In GERMAN
Avail: NTIS

The energy distributions of protons, alpha particles, and gamma quanta in neutron irradiated NaJ crystals are measured by impulse from analyses. Proton and alpha particle spectra show an effective cross section of between 206 mb and 334 mb for the complete proton yield and between 120 mb and 200 mb for the complete alpha particle yield from NaJ. Measured energy spectra of protons and alpha particles from the (n,pn + n,np) and (n,alpha + n,n alpha) reactions by coincidence counter are used to approximate the shape of the vaporization spectrum.
Transl. by G.G.

N71-30046# Oak Ridge National Lab., Tenn.
NEUTRON FLUX SPECTRUM IN THE HFIR TARGET REGION
F. B. K. Kam and J. H. Swanks 18 Mar. 1971 31 p refs
(ORNL-TM-3322) Avail: NTIS

The neutron flux spectrum in the HFIR has been determinad with computer codes ANISN and THERMOS. This spectrum was used to calculate the reaction rates of several flux monitors for which measurements were made. The results of the calculations and the measurements agreed within + or − 10%. Author (NSA)

N71-30047# California Univ., Livermore. Lawrence Radiation Lab.
LOW VOLTAGE SOURCE FOR MOLECULAR ION PRODUCTION
J. E. Osher and J. F. Steinhaus 15 Dec. 1970 11 p refs
(UCRL-50981) Avail: NTIS

A low voltage test source (LVTS I) developed for neutral beam production on the ALICE Baseball I experiments is described. This relatively small source is designed for 1- to 3-kV operation and is particularly suited to molecular ion production of (H2(+) or H3(+)). Author (NSA)

N71-30048# Rensselaer Polytechnic Inst., Troy, N.Y.
RESONANCE PARAMETERS OF Pu 240 FROM 20 TO 500 eV
R. W. Hockenbury, J. D. Boice, W. R. Moyer, and R. C. Block [1970] 7 p refs
(Contract AT(30-1)-328)
(RPI-328-223) Avail: NTIS

Neutron absorption and transmission measurements were made on Pu-240 from 20 eV to about 1 keV as part of an experiment to measure the keV capture cross section. A high-low bias technique was used in the absorption measurements to separate the fission and capture components and upper limits can be set on the fission widths of these resonances. The capture data were normalized in two ways: (1) by the saturated capture method and (2) to transmission data where both capture and transmission give essentially the same result, g Gamma n. The normalizations agree within statistics. The advantages and sources of error of each method are examined. These data were analyzed for resonance parameters. Our results for the radiation widths are 15 to 25% larger than previously reported values. Author (NSA)

N71-30052# California Univ., Livermore. Lawrence Radiation Lab.
THRESHOLD PHOTONEUTRONS AND PHOTON DOORWAYS
B. L. Berman 26 Jan. 1971 45 p refs Presented at the Am. Phys. Soc. Meeting, Stanford, Calif., 29 Dec. 1970 Sponsored by AEC
(UCRL-73003; Conf-701210-1) Avail: NTIS

The power of the threshold-photoneutron technique to examine the properties of nuclear states just above the neutron separation energy is elucidated. In particular, the discovery and delineation of doorway states in the photon reaction channel are discussed, specifically for the cases of Pb-207, Fe-57, and Pb-208. Author (NSA)

N71-30098# Stockholm Univ. (Sweden). Inst. of Physics.
STUDY OF THE DISTORTION EFFECTS IN GEOMETRICAL RECONSTRUCTION OF EVENTS IN THE CERN 2m HYDROGEN BUBBLE CHAMBER
N. Yamdagni Nov. 1970 49 p refs
(USIP-70-6) Avail: AEC Depository Libraries

Distortion effects in the geometrical reconstruction of events in CERN 2m hydrogen bubble chamber (HBC) are investigated. A short description of the chamber and the chamber calibration program CONGEN is given. The main sources of distortion in the CERN 2m HBC are radial lens distortion, and the film plane tilts. Two fitting procedures were compared: one with known radial lens distortion and another one with seven distortion coefficients. In view of the limited number of the fiducials and their location on the windows it was found realistic to fit only a few distortion coefficients. In optimizing the geometrical parameters account should be taken of the reconstruction within the chamber. The residual distortion, the distortion remaining after correcting for the two main effects, was found to be small. NSA

N71-30099# Pennsylvania Univ., Philadelphia. Dept. of Physics.
EQUIVALENCE OF (He3)-t AND d-ALPHA CLUSTER DESCRIPTION OF Li 6
R. D. Amado and J. V. Noble 8 Jan. 1971 5 p refs Sponsored by AEC
(NYO-2171-336) Avail: NTIS

The equivalence, rather than the mutual exclusion, of the (He 3)-t and d-alpha descriptions of Li-6 is pointed out. Author (NSA)

N71-30100# California Univ., Berkeley. Lawrence Radiation Lab.
EXCITED STATE PRODUCTION IN THIN FOILS FOR NEUTRAL INJECTION IN CONTROLLED THERMONUCLEAR FUSION EXPERIMENTS
Isaac Bornstein Jan. 1971 109 p refs
(Contract W-7405-eng-48)
(UCRL-20253) Avail: NTIS

Thin foils have been suggested as a charge-exchange medium for neutral injection into controlled thermonuclear fusion devices. In the experiments described here, the excited-state fraction, neutral fraction, and negative beam fractions are measured for deuterons in the energy range $10 < E < 100$ keV for thin carbon foils and for carbon foils with freshly evaporated exit layers of carbon, magnesium, niobium, and gold. Foil lifetimes are also measured for 5-micrograms carbon foils. In addition, a review is made of the literature on foil stopping power and scattering from foils. Foils are shown to have higher excited-state yields at energies below 20 keV H(+) than gases or vapors. In particular, carbon foils have a higher excited-state yield than the other foils tested. Author NSA

N71-30104# Paris Univ., Orsay (France). Institut de Physique Nucleaire.
HARTREE-BOGOLYUBOV THEORY AND APPLICATION TO THE NEUTRON-PROTON PAIRING PROBLEM
Maurice Jean [1969] 107 p refs
(NP-18538) Avail: AEC Depository Libraries

The general Hartree−Bogoliubov (HB) theory is derived, and its properties are discussed. The Hartree−Fock and BCS theories are considered as special cases of the HB theory. After application to T = 1 or T = 0 neutron−proton pairing, the theory is generalized in such a way that both T = 1 and T = 0 paring are included. It is shown that the HB theory can be used to treat on an equal footing both T = 1 and T = 0 paring correlations among nucleons. NSA

N71-30105# Roland Eotvos Univ., Budapest (Hungary). Inst. for Theoretical Physics.
SPIN AND UNITARY SPIN IN THE VENEZIANO MODEL 1
I. Montvay Apr. 1970 20 p refs
(NP-18542) Avail: AEC Depository Libraries

A general method is described by which it is possible to introduce in the generalized Veneziano model positive intercept/boson and fermion/leading trajectories without parity doubling and ghosts. The amplitudes with two and four external fermions are considered. The main hypothesis is factorization. Author (NSA)

N71-30106# Toulouse Univ. (France). Centre de Physique Atomique et Nucleaire.
MEASUREMENT OF THE SPECTRA AND FLUX OF

ELECTRONS AND PHOTONS AT ANY POINT IN AN IRRADIATED SYSTEM [MESURE DE SPECTRES ET DE FLUX PARTICULAIRES DE PHOTONS ET D'ELECTRONS ET UN POINT QUELCONQUE D'UN SYSTEME IRRADIE]
1 May 1970 40 p refs In FRENCH
(NP-18433) Avail: AEC Depository Libraries

The Monte Carlo method, used to calculated the parameters associated with the slowdown of 2- to 60-keV electrons in the multiplate geometries of liquid ionization chambers, allows one to determine each step of the electron slowdown, its energy, coordinates, direction, and displacement. Thus the effects of various types of material interfaces on the behavior of electron beams are determined. The use of surface barrier detectors with internal amplification operating in the avalanche region is studied. The technological processes for obtaining low currents are explained, and current–voltage curves are shown. NSA

N71-30107# Paris Univ., Orsay (France).
STUDY OF THE TRANSFER MECHANISMS IN THE REACTIONS Bi-209(C-12) At-210, At-211, Po-210 AND Bi-209(N-14) At-211 USING THE RECOIL METHOD
Daniel Gardes (Ph.D. Thesis) 1970 49 p refs In FRENCH
(NP-18824) Avail: AEC Depository Libraries

The cross sections, angular distributions, and recoil paths at certain angles for the radionuclides At-211, At-210, and Po-210 were determined. A preferential emission of At-210 at small angles after the bombardment of Bi with C-12 revealed a compound nucleus mechanism at energies below 80 MeV. With C-12 projectiles, transfer mechanisms involving alpha particles or He-3 were observed, in particular at high energies. In the case of alpha particle transfer the At-213 nucleus formed is excited to a sufficiently high energy to evaporate two neutrons subsequently. In the case of He-3 transfer, a neutron is emitted by the At-212. The He-4 transfer followed by the evaporation of 3 neutrons is envisaged in the production of At-210. Two other types of transfer were observed and are responsible for the production of Po-210: the simple transfer of a proton and the transfer of a deuteron followed by the evaporation of a neutron. NSA

N71-30108# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ELECTROPRODUCTION OF DELTA HYPERON(1236) IN THE PION(0) CHANNEL AT A FOUR MOMENTUM TRANSFER OF 25/(f sq)
W. Albrecht, F. W. Brasse, H. Dorner, W. Fehrenbach, W. Flauger et al Dec. 1970 14 p refs
(DESY-70/65) Avail: AEC Depository Libraries

The electroproduction of the Delta hyperon(1236) was investigated by measuring angular distributions of the outgoing proton. Coefficients of these angular distributions for a wide mass range around the resonance are given at a momentum transfer of 25/fm sq. Also given are the resonant multipoles in a small range around the resonance. The gammaNN* form factor obtained from the work at 15 and 25/fm sq is compared with other results. Author (NSA)

N71-30115# Stockholm Univ. (Sweden). Inst. of Physics.
STUDY OF PROTON-PROTON INTERACTIONS AT 19 AND 10 GeV/c
Narendra Yamdagni (Ph.D. Thesis) Nov. 1970 81 p refs
(USIP-70-7) Avail: AEC Depository Libraries

A systematic study of the final state involving four charged particles was made in pictures taken at three exposures to 19 GeV/c proton beam in a 2m hydrogen bubble chamber. The experimental procedure is described, and an outline of the beam set up together with scanning and measuring procedures is given. The study of distortion effects in the geometrical reconstruction of events resulted in a number of improvements. General features of the interactions in terms of single particle distributions are presented, and an analysis of the data in terms of various subchannels is performed. A study of 10 GeV/c was made in an exposure of pictures carried out in a 81 cm hydrogen bubble chamber. The cross section for strange particle production was found to increase rapidly with beam momentum from 4 GeV/c to 25 GeV/c. Interpreted in terms of a quasi two-body peripheral production mechanism, the results indicate a preference for nonstrange-meson exchange. NSA

N71-30116 Kansas Univ., Lawrence
A MASS SPECTROMETRIC STUDY OF CHARGE-TRANSFER REACTIONS
David Lee Smith (Ph.D. Thesis) 1969 271 p
Avail: Univ. Microfilms Order No. 70-14171

Total charge transfer cross sections for both atomic and molecular systems were investigated to assess the importance of internal energy resonance effects and Franck-Condon effects on the cross sections. Rare gas ions, molecular diatomic, and a few molecular polyatomic ions were used as projectile ions on perfluoroalkane, alkane, alkene, and diatomic targets. If the cross sections of atomic and diatomic ions of nearly the same internal energy with various target molecules are compared, the diatomic ion cross section is generally greater. Thus the Franck-Condon factor associated with the diatomic ion is less important than the greater freedom to match the internal energy levels provided by the diatomic ion. When cross sections of various projectile ions with the same target are compared, the cross sections exhibit a maximum when the ionization potential difference between the two colliding species is minimized. Dissert. Abstr.

N71-30122# Oak Ridge National Lab., Tenn.
REPORT TO THE AEC NUCLEAR CROSS SECTION ADVISORY COMMITTEE
W. M. Good Dec. 1970 42 p refs
(ORNL-TM-3205) Avail: NTIS

This memo is a collection of brief reports on recent and not yet generally publicized work at ORNL which is of special interest to the NCSAC. Included are abstracts of relevant ORNL reports, and papers which were only submitted for publication. The memo covers the period of time since the last NCSAC meeting. Author (NSA)

N71-30123# Georgia Inst. of Tech., Atlanta. School of Chemistry.
NUCLEAR SPECTROSCOPY WITH RADIOACTIVE SOURCES AND FAST NEUTRON REACTIONS Annual Progress Report, 1970
R. W. Fink 31 Oct. 1970 82 p refs
(Contract AT(40-1)-3346)
(ORO-3346-65; APR-6) Avail: NTIS

Research progress in nuclear spectroscopy and fast neutron reactions for the year ending Oct. 31, 1970 at the School of Chemistry of the Georgia Institute of Technology is summarized. The experimental equipment and facilities are described, and the personnel are listed. NSA

N71-30129# Stanford Univ., Calif. Dept. of Materials Science.
THE REPLACEMENT PARTITION FUNCTION IN HOMOGENEOUS NUCLEATION THEORY
Kazumi Nishioka, Jens Lothe (Blindern Univ., Oslo, Norway), and G. M. Pound [1970] 38 p refs Submitted for publication
(Grant NSF GK-2159)
(SU-DMS-70-T-34) Avail: Issuing Activity

The replacement partition function in the theory for homogeneous nucleation of liquid from vapor is derived by revising Kikuchi's method. It is concluded that the replacement partition function corresponds to the translational and hindered rotational motions of the cluster in the bulk liquid. In this case the relative positions of the molecules in the cluster and in the surroundings, respectively, remain fixed. Author

N71-30130 Illinois Univ., Urbana.
TIME AND TEMPERATURE DEPENDENCE OF STIMULATED BRILLOUIN SCATTERING IN FUSED SILICA
Richard Heath Stanton (Ph.D. Thesis) 1969 87 p
Avail: Univ. Microfilms Order No. 70-13502

Fused silica was selected as the principal material to be studied because of its optical and acoustic isotropy and its availability in large, optical quality samples. Also, it has the advantage of a distinct dependence of acoustic attenuation on temperature. The main difficulty in using stimulated scattering to determine phonon lifetimes is an uncertainty of whether or not steady-state scattering is achieved during the finite length of the laser pulse. Theoretically, this problem is most acute in solids, where acoustic phonon lifetimes can be of the same order of magnitude as the laser pulse length. This situation was investigated experimentally and it was found that (a) the rise of Brillouin light is much faster than predicted theoretically and (b) a reasonable fit to steady-state predictions can be obtained when the peak Brillouin power is considered as a function of the laser intensity. Dissert. Abstr.

N71-30132# Tokyo Univ. (Japan). Inst. for Nuclear Study.
NUMERICAL DIFFERENTIAL CROSS SECTIONS OF THE REACTION Ni-58(p,t)Ni-56 WITH 51.9 MeV PROTONS
T. Suehiro, Y. Ishizaki, H. Ogata, J. Kokame, A. Stricker et al 31 Oct. 1970 17 p refs
(INSJ-124) Avail: AEC Depository Libraries

Numerical values of the differential cross sections for the reaction Ni-58(p,t)Ni-56 with 51.9-MeV protons are analyzed using the proton beam extracted from the INS synchrocyclotron. Momentum analysis of the emitted tritons was made with a broad-range magnetic spectrometer. The typical energy resolution was about 100 keV. NSA

N71-30133 Illinois Univ., Urbana.
A 13 TO 27 MeV HELIUM 3 ELASTIC SCATTERING FROM SEVERAL LIGHT NUCLEI
Anthony John Buffa, Jr. (Ph.D. Thesis) 1969 227 p
Avail: Univ. Microfilms Order No. 70-13258

Be-9, B-10, B-11, C-12, Mg-24, Mg-25, Mg-26 and Al-27 targets have been bombarded with the He-3 beam from cyclotron. Elastic scattering angular distributions have been obtained in the approximate beam energy range of 13 to 27 MeV in steps of about 2 MeV and in the angular range 8 deg to 150 deg. The data were analyzed in terms of a local optical potential and a sharp edge diffraction model and the results compared to other experiments. Each isotope is discussed and possible explanations for some of the experimental discrepancies with these models are given. Dissert. Abstr.

N71-30144# Tokyo Univ. (Japan). Inst. for Nuclear Study.
QUASI-GAMMA BANDS IN Gd 152 AND POSSIBLE PRESENCE OF QUASI-K QUANTUM NUMBER
Misuo Sakai, Kameo Ishii, and Takayosh Aoki 7 Sep. 1970 16 p refs
(INS-J-123) Avail: AEC Depository Libraries

Nuclear properties of low lying excited levels of Gd-152 are discussed based on the beta transition probabilities of Eu-152. The log ft values of the beta transitions to the so-called quasi-gamma band clearly show up to be smaller than those to the members of the quasi-ground state rotational and quasi-beta bands. As Eu-152 is known to have K = 3, this fact can be explained if one assumes that the properties of the K quantum number are still alive in this transitional nucleus in the form of a quasi-K quantum number K sub q, namely K sub q = 2 for the quasi-gamma band and K sub q = 0 for the quasi-ground state rotational band and the quasi-beta band, of which the selection rules are similar to those of the K quantum number of deformed nuclei. Author (NSA)

N71-30145# Osaka Univ. (Japan). Lab. of Nuclear Studies.
SYSTEMATIC PROPERTIES OF NUCLEI. 2: GROUND STATE BANDS IN EVEN-EVEN NUCLEI
Y. Yoshizawa [1969] 82 p refs
(OU-LNS-70-2) Avail: AEC Depository Libraries

Ground state bands of 0(+), 2(+), 4(+),.....in even-even nuclei are analyzed by the power series of spin I, E = aI + bI(2) − cI(3) + dI(4). Four parameter and three parameter analyses (d = 0) give very good fits for all even-even nuclei except magic number nuclei. In the deformed region, this result shows a is approximately b, and also three-parameter analysis gives a good fit. It is concluded that a >> b >> c for the nondeformed nuclei and a equals b >> c for the deformed nuclei. The I term is essential for the difference between the deformed and the nondeformed nucleus, and the I(3) term (not I(2) (I + 1)(2) term) gives the deviation from aI + bI(2) at higher energy levels. From these results the following expression is proposed for the ground state bands of even-even nuclei in all regions except magic number nuclei: E = AI + BI(I +1) − CI(2) (I + 1). Author (NSA)

N71-30162 Michigan Univ., Ann Arbor.
AN EXPERIMENTAL DETERMINATION OF THE SUM OF THE PROTON AND ELECTRON CHARGES
Earl Walter Johnston (Ph.D. Thesis) 1969 90 p
Avail: Univ. Microfilms Order No. 70-14557

Experiments which compare the magntiudes of the proton charge q sub p and electron charge q sub e are compared. Comparative magnitudes are determined from a measurement of the net charge on two macroscopic bodies of a different mass. The charge measurements were made by suspending the bodies with a weak harmonic restoring force in a horizontal direction and measuring their displacements in an electric field applied in this direction. It was found that the net charges on two niobium bodies of 5 and 9 micrograms were (0.04 + or − 0.03)e + ne and (−0.03 + or − 0.08)e + n'e where n and n' are 0, + or − 1, + or − 2, etc. Dissert. Abstr.

N71-30188# Illinois Univ., Urbana.
A TEST OF THE DELTA S = DELTA Q SELECTION RULE IN NEUTRAL KAON SUB e3 DECAY
P. M. Mantsch, A. Abeshian, M. F. Graham, L. H. Jones, J. R. Orr et al Feb. 1971 10 p refs Sponsored in part by Midwestern Univ. Res. Assoc. Prepared in cooperation with Northeastern Univ.
(Contract AT(11-1)-1195)
(COO-1195-210) Avail: NTIS

An optical spark chamber experiment was performed to test the validity of the Delta S = Delta Q weak interaction selection rule for the decay neutral kaon (or neutral antikaon) yields pion (+ or −) e(+ or −) neutrino. Analysis of the time distribution of 342 decays has given the complex ratio, x, of the Delta S = −Delta Q to Delta S = Delta Q amplitudes to be Re(x) = −0.13 + or − 0.11 and Im(x) = −0.04 + or − 0.16 which is consistent with no violation of the Delta S = Delta Q rule. Author (NSA)

N71-30189# Illinois Univ., Urbana.
SEARCH FOR THE DECAY NEUTRAL KAON SUB S YIELDS PION(+) PION(−) PION(0)
Lewis Hammond Jones, IV (Ph.D. Thesis) Feb. 1971 142 p refs
(Contract AT(11-1)-1195)
(COO-1195-207) Avail: NTIS

A spark chamber experiment was run to search for the decay. The time distribution of kaon(0) decay into pion(+) pion(−) pion(0) was measured in the region from 0.5 to 6.5 kaon(0) sub S lifetimes. The neutral kaons were produced in a carbon target via the reaction pion(−) proton yields kaon(0) Lambda hyperon at a beam momentum of 3 GeV/c. Identification of the Lambda hyperon insured that there was no antikaon(0) contamination in the

data at t = 0. The momenta of the charged decay products were measured using thin foil spark chambers. Two charged particle tracks and one photon track, consistent with kaon(0) decay into 3 pions, were required. The time distribution for the 99 events in the final sample was fit by the method of maximum likelihood for the complex amplitude ratio x + iy = (kaon(0) sub S yields pion(+) pion(−) pion(0))/(kaon(0) sub L yields pion(+) pion(−) pion(0)). The result is x = -0.09 + or − 0.10, y = 0.56 + or − 0.43. This result indicates a possible violation of CP in kaon (0) decay into 3 pions but is also consistent with CP conservation at the one standard deviation level. The value of chi squared for x = y = 0 is 6.10 for four degrees of freedom with chi squared probability = 19.2%. Author (NSA)

N71-30190# Illinois Univ., Urbana.
SEARCH FOR THE DECAY NEUTRAL KAON SUB S YIELDS PION(+) PION(−) PION(0) Summary
L. H. Jones, A. Abashian, M. F. Graham, P. M. Mantsch, J. R. Orr et al Feb. 1971 13 p refs
(Contract AT(11-1)-1195)
(COO-1195-209) Avail: NTIS

An optical spark chamber experiment was performed to search for the decay neutral kaon sub S yields pion(+) pion(−) pion(0). The neutral kaons were produced by 3 GeV/c negative pions in the reaction pion(−) proton yields Lambda hyperon Kaon(0). There were 99 events with decay times between 0.5 and 6.5 kaon(0) sub S lifetimes analyzed to give x + iy, the ratio of the amplitude kaon(0) sub S yields pion(+) pion(−) pion(0) to the amplitude kaon(0) sub L yields pion(+) pion(−) pion(0). The values x = -0.09 + or − 0.10 and y = 0.56 + or − 0.43 were obtained. Author (NSA)

N71-30191# Illinois Univ., Urbana.
TEST OF THE DELTA S = DELTA Q SELECTION RULE IN NEUTRAL KAON SUB (MUON 3) DECAY
Michael Francis Graham (Ph.D. Thesis) Jun. 1971 129 p refs
(Contract AT(11-1)-1195)
(COO-1195-206) Avail: NTIS

The theoretical time distribution for the neutral kaon decay into 3 muons contains a complex parameter x'. The neutral kaons were obtained from 3.0 GeV/c negative pions striking a carbon target giving the reacton pion(−) proton yields Lambda hyperon kaon(0). Counters, optical spark chambers, and a spectrometer magnet were used to record kaon(0) decays into 3 muons on film for reconstruction on a computer. The detection of the proton from Lambda hyperon yields pion(−) proton was used as a trigger requirement to indicate associated production of the kaon(0). The muon from the kaon(0) decay was detected by counters placed behind a steel absorber used to suppress the kaon(0) decay into 2 pion background. A sample of kaon(0) decay into 3 muon events decaying between 0.5 and 6.5 kaon(0) sub S lifetimes was obtained. A fit to the data with the theoretical time distribution corrected for experimental detection efficiency was made. Maximum likelihood was used to obtain the best estimators of the parameters Re(x') and Im(x') of the theoretical distribution. The results obtained for 100 events were: Re(x') = 0.4 (+ .10 or -.13, Im(x') = 0.12 +.17 or -.16. These results are consistent with the Delta S = Delta Q rule and CP symmetry. Author (NSA)

N71-30192# Illinois Univ., Urbana.
TEST OF THE DELTA S = DELTA Q SELECTION RULE IN NEUTRAL KAON SUB (MUON 3) DECAY Summary
M. F. Graham, A. Abashian, L. H. Jones, P. M. Mantsch, J. R. Orr et al Feb. 1971 11 p refs Sponsored in part by AEC and Midwestern Univ. Res. Assoc.
(COO-1195-208) Avail: NTIS

A test of the Delta S = Delta Q selection rule in kaon(0) decay into 3 muons was performed using optical spark chambers. The neutral kaons were produced by 3 GeV/c negative pions in the reaction pion(−) proton yields Lambda hyperon kaon(0). There were 100 events with proper decay times between 0.5 and 6.5 kaon(0) sub S lifetimes analyzed to give a ratio of the Delta S = −Delta Q to Delta S = Delta Q amplitudes Re(x') = 0.04 +.10 or −.13, Im(x') = 0.12 +.17 or −.16. Author (NSA)

N71-30214 California Univ., Berkeley.
HIGH RESOLUTION ELECTRONIC SPECTRA OF ORGANIC MOLECULES IN LOW TEMPERATURE MATRICES: THE SHPOLSKII TECHNIQUE
Robert Marshall Macnab (Ph.D. Thesis) 1969 211 p
Avail: Univ. Microfilms Order No. 70-13110

The occurrence of an electronic transition of a guest molecule in a low temperature mixed crystal, without any accompanying change in the phonon energy of the host is considered. Because the guest is uncoupled from the environment, its spectrum consists of narrow bands which enable precise determination of electronic and vibrational energies. The spectra usually have a multiplet structure; there are several electronic origins, each giving rise to a vibronic spectrum. This is believed to result from a multiplicity of substitutional sites in the host crystal. Typical systems for which the effect is observed are aromatic molecules in n-alkane matrices. Size of the n-alkane is critical. Attempts to extend the technique to biologically interesting molecules were largely unsuccessful. Dissert. Abstr.

N71-30215# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.
VIBRATION-ROTATION INTERACTION EFFECTS IN CALCULATED BAND STRENGTHS
B. Chakraborty and Y. K. Pan Apr. 1971 17 p refs
(Contract N00014-69-A-0453)
(AD-722811; FRK-113) Avail: NTIS CSCL 7/4

The effects of vibration-rotation interaction on the band strengths for various J values of the transitions B triplet Pi(g)-A triplet Sigma(u)(+) for N2 and doublet Sigma(+)-doublet Pi(i) for OH have been studied by the asymptotic expansion method. Author (GRA)

N71-30216# California Univ., Berkeley. Lawrence Radiation Lab.
KAON(+) DEUTERON INTERACTIONS FROM 865 TO 1365 MeV/c
Allan Akira Hirata (Ph.D. Thesis) 1 Oct. 1970 123 p refs
(Contract W-7405-eng-48)
(UCRL-20248) Avail: NTIS

Some detailed experimental results are presented on the Kaon(+) deuteron interactions from 865 to 1365 MeV/c incident beam momentum. Measurements on several Kaon(+) deuteron partial cross sections are presented, and most of the others are calculated using relations derived from isospin conservation and data from other experiments. The most striking feature of the cross section data is the abrupt rise of the total single-pion-production cross section near 1200 MeV/c. The charge exchange data are compared with the predictions of a Regge model and they are found to be consistent with the results of high-energy fits. The reaction KN yields K*N near threshold is studied and it is found that the data can be easily interpreted in terms of t-channel phenomena. Author (NSA)

N71-30222# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique.
SIXTH-ORDER RADIATIVE CORRECTIONS TO THE ANOMALOUS MAGNETIC MOMENT OF THE ELECTRON
J. Calmet and M. Perrottet 1970 8 p refs
(CNRS-CPT-70-P-339) Avail: AEC Depository Libraries

The sixth-order contributions to the anomalous magnetic moment of the electron from the Feynman diagrams with vacuum polarization insertions were computed. This computation was done by means of a program devoted to the calculation of the Feynman diagrams finite contributions. NSA

N71-30223# Northeastern Univ., Boston, Mass. Dept. of Physics.
SUM RULES AND THE LANDAU THEORY OF FERMI LIQUIDS
Emil Safier and Allan Widom May 1971 19 p refs
(NUB-2073) Avail: NTIS

The Landau theory predicts spectral weight functions for density and spin density fluctuations which in the long wavelength low frequency limit should be equal to the true spectral weight functions of a system of interacting fermions. This correspondence plus well known frequency sum rules provides a means to examine the Landau quasi-particle interaction parameters. Two inequalities are derived; F1 > or = to G1 and another relating the first three spin symmetric Landau coefficients to the radial distribution function and the two particle potential. It is found that the third moment sum rule is not entirely exhausted by Landau accountable excitations, and therefore it is the highest order sum rule which can still probe the theory. A third moment sum rule for the spin-spin correlation function is derived and is found to have an unexpected dependence on k vector; i.e., one that disagrees with the corresponding Landau prediction. Author

N71-30225 Illinois Univ., Urbana.
MICROWAVE SPECTROSCOPIC STUDIES OF NUCLEAR QUADRUPOLE COUPLING, BARRIERS TO INTERNAL ROTATION, AND THE ZEEMAN EFFECT
Robert George Stone (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms Order No. 70-13506

The microwave spectrum of cis-1-chloro-2-fluoropropene was observed in the ground torsional state of both Cl-35 and Cl-37 isotopic species. Rotational constants and nuclear quadrupole coupling constants along the internal axes chi sub aa, chi sub bb, and chi sub cc are given for the Cl-35 and Cl-37 species. The microwave spectra of 1,1-difluoro-2-chloroethylene, chlorotrifluoroethylene, and 1-chloro-1-fluoroethylene were examined to determine their Cl-35 nuclear quadrople coupling constants in the field gradient axis system. The Zeeman effect, first- and second-order in the magnetic field, was observed in phosphorus trifluoride, nitrogen trifluoride, phosphoryl fluoride, sulfur tetrafluoride, thionyl fluoride, and sulfuryl fluoride. An infrared microwave double irradiation experiment was designed, which allowed a more complete study of vibrational relaxation times in gaseous molecules. Dissert. Abstr.

N71-30231# Oak Ridge National Lab., Tenn.
NEUTRON PHYSICS DIVISION Annual Progress Report, Period Ending 31 May 1970
Sep. 1970 116 p refs
(Contract W-7405-eng-26)
(ORNL-4592) Avail: NTIS

Neutron physics data are presented. The data covers neutron spectra in the upper atmosphere, elastic scattering in carbon-12, uranium-233 and 238, and reactions with fissile nuclei. Data are also given for neutron capture, and a matrix analysis is presented. E.H.W.

N71-30268# California Univ., Livermore. Lawrence Radiation Lab.
BUBBLE CHAMBER STUDY OF POLARIZED GAMMA PROTON YIELDS PION(+) PION( ) PROTON AT 2.8 AND 4.7 GeV
Kenneth Charles Moffeit (Ph.D. Thesis) Nov. 1970 153 p refs Sponsored in part by NSF
(Contract W-7405-eng-48)
(UCRL-19890) Avail: NTIS

A nearly monochromatic and linearly polarized photon beam produced by Compton backscattering of ruby laser light was used to study the reaction gamma proton yields pion(+) pion( ) proton at 2.8 and 4.7 GeV in a hydrogen bubble chamber. The rho meson production and decay via gamma proton yields rho(0) meson proton are studied and found to proceed almost completely through natural parity exchange. The behavior of the density matrix elements shows that the rho meson production mechanisms conserves s-channel c.m.s. helicity for the absolute value of t 0.4 Ge(V sq). The dependence of the rho(0) meson mass shape on the momentum transfer is inconsistent with the Ross-Stodolsky factor. Evidence is presented for an interference of rho(0) meson production with background. The data are compared with models including that of Soding, and the total and differential cross sections for rho(0) meson production are presented. The rho(0) meson-omega meson interference parameters were measured. The production of Delta (1236) hyperon via gamma proton yields Delta(2-) hyperon pion(-) (Delta(0) hyperon pion(-)) was studied in the reaction gamma proton yields pion(-) pion-) proton. Cross sections and measurement of the parity asymmetry are presented. Author (NSA)

N71-30269# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
APPARATUS FOR THE STUDY OF RADIOLYTIC CARBON DEPOSITION FROM THE GAS PHASE
R. S. Sach and R. F. Skinner Jul. 1970 22 p refs
(RD/B/N-1748) Avail: AEC Depository Libraries

A description is given of an apparatus designed to study the deposition of C-14 labeled gas mixtures, containing CH4, CO, or inactive gas, under gamma radiation at temperatures up to 900 K and pressures up to 40 bars. The deposit is determined using simple oxidation techniques and counting the C(14)O2 produced. The analytical equipment is fully automatic. NSA

N71-30270# Virginia Univ., Charlottesville. Dept. of Physics.
SPECTRA AND APPLICATION OF WHITE NEUTRONS FROM DEUTERON BOMBARDMENT OF BERYLLIUM
L. Cranberg, J. P. Barnett, D. S. Cramer, and R. D. Wilson [1970]
Avail: NTIS 12 p refs Sponsored in part by NSF

Data are reported on the spectra of neutrons produced by bombardment of a thick beryllium target by pulsed deuterons of 5.2 MeV energy at several angles of observation. The neutrons produced at 45 degrees are used to measure the transmission of carbon and polyethylene samples to illustrate application of the neutron source to the measurement nuclear excitation functions in the energy range below 8.5 MeV, using time of flight monochromatization. Comparisons with other systems are discussed. Author

N71-30271# Stockholm Univ. (Sweden). Inst. of Physics.
ONE-PION EXCHANGE MODEL APPLIED TO THE REACTION PROTON PROTON YIELDS PROTON PION(+) DELTA HYPERON (2+) PION(-) PROTON AT 19 Gev/C
Lars Brink and Sven-Olof Holmgren Oct. 1970 19 p refs
(USIP-70-5) Avail: AEC Depository Libraries

Predictions of a one pion exchange model (OPE) applied to proton-proton yields proton pion(+) delta hyperon proton pion( ) at 19 GeV/c are compared to experimental data produced by the Scandinavian collaboration in a bubble chamber experiment using the CERN 2m HBC. Limiting forms of reggeized models are compared to the OPE formulas and used in the interpretation of the results. Author (NSA)

N71-30272# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
PION(+) PHOTOPRODUCTION AT 180 DEG ON H FROM 450 MeV TO 3 GeV [PHOTOPRODUCTION DU MESON PION(+) SUR L'HYDROGENE A 180 DEG ENTRE 450 MeV ET 3 GeV]
B. D'Almagne (Ph.D. Thesis) Oct. 1970 113 p refs In FRENCH
(LAL-1239) Avail: AEC Depository Libraries

The photoproduction of pion(+) at 180 deg with protons is described. The aim of the experiment was to complete over a large energy range (450 MeV to 3 GeV) previously obtained data on the first resonance zone and to determine the structure of the

cross sections observed in the region of the second resonance. The three distributions obtained by the integration of the 810 to 880 MeV, the 1625 to 1850 MeV, and the 1970 to 2230 MeV angular distributions were without structure. The experiment demonstrated that the second resonance is dominated by the D13 wave in the 3/2 helical state and the S11 wave but did not allow the effect of the P11 resonance to be determined. The structure in the 700 MeV region is explained by a cusp effect at the threshold energy for neutral eta meson photoproduction. The third resonance is essentially photoproduced in the 3/2 states of helicity, but at energies in excess of 1 GeV the effect due to resonances at higher energies becomes significant. At energies in excess of 900 MeV a strong structure was observed. NSA

N71-30289 Cornell Univ., Ithaca, N.Y.
NUCLEAR MAGNETIC RESONANCE MEASUREMENT OF SELF-DIFFUSION IN LIQUID LITHIUM 7, LITHIUM 6, AND SODIUM
James Stanley Murday (Ph.D. Thesis) 1970 149 p
Avail: Univ. Microfilms Order No. 70-12637

The diffusion coefficient was determined from observations of the dependence of the spin-echo signal upon the amplitude of the pulsed gradient. The self-diffusion coefficients at the melting point were found to be 5.7 + or − 0.000005 sq cm/sec for Li-7 in 99.99% Li-7, 0.01% Li-6; 6.7 + or − 0.000006 sq cm/sec for Li-6 in 99% Li-6, 1% Li-7; and 3.6 + or − 0.000003 sq cm/sec for Na-23 in pure Na-23. The temperature dependence of D at the melting point was found to be 0.035 + or − 0.003 × 10 to the minus 5th power sq cm/sec C for both lithium metals and 0.035 + or − 0.003 × 10 to the minus 5th power sq cm/sec C for sodium. These values were generally smaller than known tracer measurements for mutual diffusion in molten sodium and lithium. The self-diffusion coefficients of Li-7 and Li-6 in several isotopic lithium alloys were measured and found to be relatively independent of alloy composition. The results were compared with the Stokes-Einstein relation, the Cohen-Turnbull free volume model, and the Ascarelli-Paskin dense-gas model for liquid metal diffusion. Dissert. Abstr.

N71-30295*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF HEAVY NUCLEI CHARGES [OB OPREDENLENII ZARYADOV]
V. B. Semikoz Washington NASA Jul. 1971 9 p refs Transl. into ENGLISH from Russian report Pr-13
(Contract NASw-2035)
(NASA-TT-F-13743; Pr-13) Avail: NTIS CSCL 20H

The number of delta-electrons formed by N = Z/(137 beta), where Z is the charge, and beta is the velocity of the nucleus, is calculated. Good agreement was observed with the Born formula (at eta < 0.3) and with the Rutherford formula (at eta > 1.5), which give the same results in extreme cases (eta << 1 and eta >> 1, respectively). If the parameter eta is approximately 1, then it is necessary to use the exact Mott formula for differential cross sections whose numerical integration is carried out with allowances for kinematic scattering of the nucleus by target electrons. In this case, the introduced correction to charge Z sub 15, determined in the first Born approximation, is very large, especially for the heavy nuclei of the SH group. Author

N71-30297# Virginia Univ., Charlottesville.
POLARIZED NEUTRONS FROM THE H-3(p,n) He-3 REACTION
D. S. Cramer and L. Cranberg [1970] 15 p refs
Avail: NTIS

The polarization of neutrons from the H-3(P,n)He-3 reaction at 31.6 degrees in the lab (approximately 45 degrees in the center of mass) was measured, using He-4 in the form of a pressurized gas as a polarimeter in conjunction with a time-of-flight spectrometer. Polarization has been attributed to the interference of the 3PO and 3P2 waves, forming the T = 0; J sup pi = 0(−),2(−) states in He-4 at 21.4 and 22.9 MeV, respectively. Observed polarizations are larger than those predicted by theory and indicate a needed adjustment of the spacing and position of the above T = 0 levels. Author

N71-30298*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLUTION OF AN INITIAL-VALUE PROBLEM IN LINEAR TRANSPORT THEORY: MONOENERGETIC NEUTRONS IN A SLAB WITH INFINITE REFELCTORS
Perry A. Newman (Ph.D. Thesis − Va. Polytechnic Inst., 1969) and Robert L. Bowden (Va. Polytechnic Inst.) Washington May 1971 115 p refs
(NASA-TR-R-357; L-7208) Avail: NTIS CSCL 20H

The solution of an initial-value problem in linear transport theory is obtained by using the normal-mode expansion technique of Case. The problem is that of monoenergetic neutrons migrating in a thin slab surrounded by infinitely thick reflectors and the scattering is taken to be isotropic. The results obtained indicate that the reflector may give rise to a branch-cut integral term typical of a semi-infinite medium whereas the central slab may contribute a summation over discrete residue terms. Exact expressions are obtained for these discrete time eigenvalues, and numerical results showing the behavior of real time eigenvalues as a function of the material properties of the slab and reflector are presented. These eigenvalues are finite in number and may disappear into the branch cut or continuum as the material properties are varied; such disappearing eigenvalues correspond to exponentially time-decaying modes. The two largest eigenvalues can be compared with critical dimensions of slabs and spheres, and the numerical values are shown to agree with the criticality results of others. In the limit of purely absorbing reflectors or a bare slab, the present solution has the same properties as have been previously reported by others who used the approach of Lehner and Wing. Author

N71-30299# Stockholm Univ. (Sweden). Inst. of Physics.
PROTON-PROTON REACTIONS AT 19 GeV/c WITH PRODUCTION OF TWO AND THREE PIONS
J. Eades (Univ. of Copenhagen), K. Hansen (Univ. of Copenhagen), H. Johnstad (Univ. of Copenhagen), R. Mollerud (Univ. of Copenhagen), L. Veje (Univ. of Copenhagen) et al Oct. 1970 47 p ref Presented at the 14th Intern. Conf. on High Energy Phys., Vienna, 1968
(USIP-70-4; Conf-680809-46) Avail: AEC Depository Libraries

The exposure of 25,000 4-prong events from an exposure of the CERN 2-meter HBC to a 19-GeV/c proton beam were measured and passed through the CERN Thresh-Grind computer programs. Fits were obtained to the three channels: (1) proton proton yields proton proton positive pion negative pion, (2) proton proton yields neutron proton positive pion positive pion negative pion, (3) proton proton yields proton proton positive pion negative pion neutral pion. The observed branching of the reactions into various channels is described. The following cross sections were obtained: sigma (1) = 1.5 + or − 0.2 mb, sigma (2) = 1.7 + or − 0.3 mb, and sigma (3) = 1.7 + or − 0.3 mb. Some features of the double Regge pole exchange model were tested on the channel proton proton yields delta++ negative pion proton. A one-pion exchange calculation indicates that only a part of the low mass enhancement in the delta++ negative pion system of the first reaction can be explained as a kinematic effect resulting from delta++ production in association with diffraction scattering. NSA

N71-30300# Rensselaer Polytechnic Inst., Troy, N.Y.
OBSERVATION OF CORRELATIONS BETWEEN NEUTRAL GAMMA SUB n AND GAMMA SUB GAMMA IN THE MASS RANGE 50 TO 60
R. C. Block, R. G. Stieglitz, and R. W. Hockenbury [1970] 7 p refs
(Contract AT(30-1)-328)
(RPI-328-222) Avail: NTIS

Neutron capture and transmission measurements in the keV energy region Cr-50, Cr-52, Cr-53, Cr-54, V-51, and Ni-60 enabled 27 s-wave resonances to be analyzed for E sub o, J, pi, Gamma sub n, and Gamma sub gamma. The correlation coefficients between the reduced neutron width and the total radiation width rho(neutral Gamma sub n, Gamma sub gamma) are rho = 0.47 for all 27 resonances, rho = 0.38 for the 15 resonances in the odd (target) nuclei, and rho = 0.80 for the 12 resonances in the even-even nuclei. The latter value of 0.80 is beyond the 99% confidence limit for a significant correlation to exist. In addition, the resonance-capture pulse-height spectra are dominated by strong high-energy gamma rays, which are interpreted as E1 transitions. This positive correlation, coupled with the strong E1 transitions, is interpreted as evidence of intermediate structure. Author (NSA)

N71-30305# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
ON THE DELTA S = 2 TRANSITIONS IN THE NONLEPTONIC HYPERON DECAYS
Michiji Konuma, Koji Kurata, and Kimio Sugano Mar. 1971 16 p refs
(RIFP-120) Avail: NTIS

The nonleptonic hyperon decay is treated with Delta S-2, and Xi hyperon yields N pion. From this treatment the decay rates and the asymmetry parameters are obtained along with the second order effect of the usual current-current interaction. In the latter case use is made of the baryon pole model. The comparison between the two calculations shows that there is a possibility of large reduction of the asymmetry parameters of the decay Xi hyperon yields N pion in the presence of the above mentioned neutral current. Author

N71-30306 Illinois Inst. of Technology, Chicago.
LOW MOMENTUM NEGATIVE KAON-HELIUM 4 SCATTERING, 115-160 MeV/c
John Glenn McComas (Ph.D. Thesis) 1970 207 p
Avail: Univ. Microfilms Order No. 70-13561

The differential cross section for K(+)- He-4 elastic scattering based on 254 events with K(-) laboratory momenta in the interval 115 to 160 MeV/c is reported. The elastic data and measurements of the total absorption cross section were fitted with a Coulomb modified partial wave series comprised of s- and p-wave terms with complex phase shifts, yielding two solutions with comparable confidence levels. Results are not consistent with an absolute K alpha X-ray yield exceeding 1%. The s- and p-wave results are in good agreement with those from another K(-) - He-4 scattering experiment. Dissert. Abstr.

N71-30307# Kyoto Univ. (Japan). Dept. of Physics.
NEUTRINO PRODUCTION OF LEPTON PAIR, 1
Kazuo Koike, Michiji Konuma, Koji Kurata, and Kimio Sugano 1971 46 p refs
(RIFP-121) Avail: NTIS

The neutrino production of lepton pair in an electromagnetic field of nucleus is treated. Using the local Fermi interaction together with the electromagnetic form factor of nucleus, we derive analytically the differential cross section d sup 2 delta/dr sub 1 dr sub 2 in the case where the incident neutrino momentum and two produced charged lepton momenta r sub 1 are coplanar. Author

N71-30308# Maryland Univ., College Park. Center for Theoretical Physics.
Pi N CHARGE EXCHANGE POLARIZATION AND THE VIOLATION OF THE POMERANCHUK THEOREM
D. Schiff and H. Yabuki May 1971 10 p refs
(Grants NSF GU-Z061; NSF GP-8748)
(TR-71-117) Avail: NTIS

The violation of the Pomeranchuk theorem is shown to induce an energy trend for the small t pion(-) p yields neutral pion n polarization which may differ notably from the conventional model predictions already in the range 20 < p sub lab < 50 BeV. Author

N71-30309 Maryland Univ., College Park.
EXPERIMENTAL STUDY OF THE MUONIC DECAYS OF SIGMA HYPERONS
Neil Vance Baggett (Ph.D. Thesis) 1969 121 p
Avail: Univ. Microfilms Order No. 70-13706

This experiment is based on observations of 540,000 3 view photographs from the AGS 30 inch hydrogen bubble chamber, exposed to a beam of stopping K(-) mesons. The film, containing a total of 2.1 x 10 to the 6th power negative sigma hyperon and 1 million positive sigma hyperon from stopping K(-), was scanned for the decays positive sigma- hyperon yields N muon + or - neutrino in which the muon stops and decays to an electron or positron. No examples of positive sigma hyperon yields neutron muon positive neuterino were found. Dissert. Abstr.

N71-30310# Maryland Univ., College Park. Center for Theoretical Physics.
PARTON MODEL WITH VARIABLE INTERMEDIATE STATE PARTON MASS
O. W. Greenberg and D. Bhaumik May 1971 refs
(Grants NSF GP-8748; NSF GU-2061)
(TR-71-111) Avail: NTIS

The parton model is modified by allowing the parton mass to change after absorbing the space like photon. Each prescription for the intermediate state parton mass leads to a model with a definite scaling variable and to a scale breaking factor which describes the approach to scaling. The model with the Bloom variable omega' has the required linear zero at Q(2) = 0 in nuW sub 2, and has a scale breaking factor which agrees with experiment for 1 < or = omega < or = 12. The prescription that the parton mass vanish after absorbing the photon leads to the scaling variable omega which also occurs in the light cone singularity dominance model. Models which allow agreement of the sum rule for the mean squared charge per parton with experiment are given, as are models which have diffractive behavior for Q(2) near zero. Author

N71-30311# Virginia Univ., Charlottesville. Dept. of Physics.
GAS TARGET FOR PRODUCTION OF MONOENERGETIC NEUTRONS
D. S. Cramer and L. Cranberg [1970] 8 p refs
Avail: NTIS

A new design of gas target cell is described for neutron production. Results are given on effects attributed to diffusion of tritium gas from the cell into the window material. Author

N71-30323# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ON THE MULTIPLE PROCESSES AT VERY HIGH ENERGIES
E. I. Daibog and I. L. Rosental 1971 48 p refs
(PR-44) Avail: NTIS

The possible collective interactions of colliding particles at very high energies are analyzed. Experimental data show that these interactions may be statistical or hydrodynamical. The hydrodynamical interactions are considered taking into account Landau's hydrodynamic theory. Some heuristic aspects of the theory are pointed out. ESRO

N71-30327# Helsinki Univ. (Finland). Dept. of Radiochemistry.
THE DECAY OF THE Sn 127 ISOMERS
Elisabeth Helander Sep. 1970 48 p refs
(NP-18596) Avail: AEC Depository Libraries

Gamma- and X-rays emitted in the decay of 2.2 h and 4.1 min Sn-127 were investigated with the aid of Ge(Li) Si(Li) detectors. Sources were prepared by the Te-130(n,alpha)Sn-127

reaction followed by chemical separation. Altogether 62 gamma-rays were attributed to the decay of 2.2 h Sn-127 and 3 to that of 4.1 min Sn-127 . Gamma-gamma coincidence and anticoincidence relationships in the decay of 2.2 h Sn-127 were observed with various Ge(Li)-Ge(Li) and Ge(Li)-Na(Tl) detector combinations. It is suggested that the 4.1 min 3/2(+)isomer of Sn-127 represents the ground state and the 2.2 h 11/2(-) isomer the first excited state in Sn-127. A level scheme of Sb-127 was constructed, involving levels at 0, 491, 1096, 1114, 1585, 1920, 1938, 1955, 2004, 2094, 2098, 2124, 2140, 2150, 2222, 2247, 2275, 2318, 2353, 2360, 2412, 2457, 2479, 2501, 2531, 2588, 2612, 2692, 2697, 2764, 2785, 2806, 2847, and 2881 keV. The low-lying levels of the odd-mass antimony isotopes vary smoothly through the series Sb-119 to Sb-127. Author (NSA)

N71-30328# Lyon Univ. (France.)
THE STUDY OF THE (2p-1h) COMPONENTS OF THE EXCITED STATES OF O 17 AND SI 29 BY DOUBLE STRIPPING REACTIONS [MISE EN EVIDENCE DES COMPOSANTES 2p-1t DES ETATS EXCITES DE O 17 ET SI 29 PAR REACTION DE DOUBLE STRIPPING]
Marie-Claude Lemaire (Ph.D. Thesis) 1970 108 p refs
(NP-18628) Avail: AEC Depository Libraries

Proton double-stripping reactions at 18 MeV (He-3, proton) with N-15 and Al-27 were studied experimentally in order to investigate the population of O-17 and Si-29 levels. The principles and the techniques used in DWBA cross-section calculations for two-nucleon transfer reactions were recalled; the methods behind the choice of optical parameters were indicated. The experimental results and the spectroscopic information that may be deduced from the DWBA analysis of the angular distributions were presented The selectivity of these two stripping reactions experimentally demonstrates the intensity of the (2p-1h) force in the wave functions of the different excited levels of O-17 and Si-29. NSA

N71-30329# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique.
APPROACH TO FORM FACTOR IN A COMPOSITE MODEL
Raoelina Andriambololona and C. Bourrely Jun. 1970 23 p refs
(CNRS-CPT-70-P-331) Avail: AEC Depository Libraries

The electromagnetic form factor of the nucleon was derived from a composite model; the relation between the form factor and structure function of the composite nucleon was studied in detail, and the problem of the form factor in nucleon-antinucleon elastic scattering was investigated. NSA

N71-30330# Paris Univ., (France).
THE PRODUCTION OF STRANGE PARTICLES IN PION(+) DEUTERON INTERACTIONS AT 5.1 GeV/c: 2-BODY AND QUASI-2-BODY REACTIONS [PRODUCTION DE PARTICULES ETRANGES DANS DES INTERACTIONS PION(+) DEUTERON A 5, 1 GeV/c: REACTIONS A 2-CORPS ET A QUASI-2-CORPS]
Denyse Mettel (Ph.D. Thesis) 1970 172 p refs In FRENCH
(NP-18629) Avail: AEC Depository Libraries

Strange particles produced by positive pion deuteron interactions at 5.1 GeV/c were studied. The principal interest of experiments with a deuterium target is the possibility of obtaining interactions in which either the deuteron remains intact or the incident beam interacts with the neutron. If the impulse approximation model is used a quasi-free neutron target may be used in conjunction with the last hypothesis. Cross sections for all the positive pion neutron interactions in the final state with 2, 3, 4, and 5 bodies, were evaluated. The analysis of reactions associated with kaon antikaon and Y kaon is described in detail. A systematic study was made of resonances which could lead to the observation of quasi-2-body reactions; the various results of the 5.1 GeV/c experiment were deduced. In particular, the angular distributions the disintegration products of a resonance and the evaluation of the spin density matrix allowed comparisons to be made with the previous OME model. All the experimental results of the two-body and quasi-two-body reactions were used in a more general pion-nucleon interaction model and the values deduced were compared with the more simple Regge pole model. A more complicated Regge pole model using a double pole was studied in order to explain results concerning the polarization of the neutral Lambda of the two body positive pion neutron yields neutral Lambda positive k interaction. NSA

N71-30331# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
CALCULATION OF ISOTOPIC REACTIVITY CHANGES BY PERTURBATION THEORY IN THE MULTIGROUP DIFFUSION APPROXIMATION [IZOTOPICKE EFEKTY REAKTIVITY S POUZITIM TEORIE PORUCH VO VIACGRUPOVOM DIFUZNOM PRIBLIZENI]
I. Tinka [1970] 15 p refs In SLOVAK
(UJV-2398-RF) Avail: AEC Depository Libraries

Formulas are given for the calculation of reactivity after insertion of various substances into the reactor, and the EREIS program set up in the GIER-ALGOL III code for the GIER computer is described. The program was employed to perform physics computations for the ZRR experimental fast reactor. Some of the results are given in tables and graphs. NSA

N71-30335# Syracuse Univ., N.Y. Dept. of Physics.
RELATIVISTIC WAVE EQUATION FOR PARTICLES WITH ARBITRARY SPIN
William J. Hurley Apr. 1971 34 p refs Sponsored by NSF
Avail: Issuing Activity

Relativistic wave equations are derived which generalize the Galilei-covariant wave equations for massive particles with any integer or half-integer spin. Imposing a minimality condition on the number of components possessed by the relativistic wave function, it is shown that the index transformation properties of the wave function may be either those of the direct sum (s,0) + (s - 1/2, 1/2) representation of SL(2,C) or of the representation, (0,s) + (1/2, s - 1/2). The minimal extension of these representations which accommodates reflection symmetry yields the Dirac equation for s = 1/2, the Duffin-Kemmer equation for s = 1 and an equation for particles with s > 1 whose wave function indices transform according to the direct sum (s,0) + (s - 1/2, 1/1) + (1/2, s - 1/2) + (0,s) representation of SL(2,C). The latter theory possesses 4(2s+1) independent components, has no subsidiary conditions and describes a unique mass, m not = to 0, and a unique spin. The theory admits a simple Lagrangian and Hamiltonian formulation and yields a conserved current. Finally, it is shown that for any spin the equation remains consistent and causal in the presence of a minimally coupled external electromagnetic field interaction. Author

N71-30338# Helsinki Univ. (Finland). Dept. of Physics.
ENERGY LEVELS OF Yb 176 FROM THE DECAY OF Tm 176 AND Yb 176
T. Tuurnala, V. Pursiheimo, and E. Liukkonen Feb. 1970 23 p refs
(NP-18599) Avail: AEC Depository Libraries

The decay of Tm-176 has been studied by means of Ge(Li) detectors and some gamma-gamma as well as gamma-beta coincidence arrangements. For the half-life of Tm-176 a value of 1.9 + or - 0.1 min was measured. A total of 31 gamma rays were assigned to the decay of Tm-176. According to the proposed level scheme these depopulate 19 levels in Yb-176, of which those at 977, 1360, 1599, 1673, 2142, 2372, 2411, 2954 and 3188 keV are new. Spin and parity assignments are suggested for some of these levels and for the ground state of Tm-176. In addition, four gamma transitions possibly belonging to an isomer in Tm-176 were found with energies 116.3, 122.3, 193.8 and 199 .0 keV and

with half-life 1.4 + or − 0.1 min. Also the decay of Yb-176 has been reinvestigated the results obtained being consistent with the previous data. Author (NSA)

N71-30337# Maryland Univ., College Park. Dept. of Physics and Astronomy.

PARTIAL WAVE ANALYSIS OF KAON(+) PROTON ELASTIC SCATTERING

B. Barnett, J. Goldman, A. Laasanen, and P. H. Steinberg 1970 22 p refs

(Contract AT(40-1)-2504)

(ORO-2504-151; TR-70-101) Avail: NTIS

A partial-wave analysis of elastic scattering at 0.78 to 1.45 GeV/c is described. The purpose of this analysis is to determine whether a previously found bump in the kaon(+) proton total cross sections at 1.2 GeV/c is due to a resonance in the direct channel, generally referred to as Z1*. It is found that a persistent feature of all the solutions is the suggestion of a counter-clockwise rotation of the P3/2 partial-wave amplitude on the Argand plot. However, reluctance is stated in offering this result as significant evidence for a Z*(1830). NSA

N71-30338# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.

APPROXIMATION OF LINEAR COEFFICIENTS mu and mu sub a FOR GAMMA RAY BY A TWO DIMENSIONAL POLYNOMIAL

V. Valenta and K. Vlachovsky 1970 28 p refs

(ZJE-93) Avail: AEC Depository Libraries

Approximate expressions for the total mass coefficient (mu(E,Z)/rho) and the mass coefficient (mu sub a(E,Z)/rho) are included for absorbed energy of gamma rays for atomic numbers Z = 1 to Z = 92 for two ranges of energy E = 0.2 to 2 MeV and E = 2 to 15 MeV. Author (NSA)

N71-30340*# Scientific Translation Service, Santa Barbara, Calif.

ON THE RELATIONSHIP BETWEEN THE ENERGY-IMPULSE VECTOR AND THE CANONICAL IMPULSE IN RELATIVISTIC MECHANICS [O SVYAZI MEZHDU VEKTOROM ENERGII-IMPULSA I KANONICHESKIM IMPULSOM V RELYATIVISTSKOY MEKHANIKE]

Yu. A Rylov Washington NASA Jul. 1971 11 p refs Transl. into ENGLISH of Acad. of Sci. USSR, Inst for Space Res., Moscow, report Pr-3

(Contract NASw-2035)

(NASA-TT-F-13730) Avail: NTIS CSCL 20H

The possibilities of relativistic mechanics are expanded. It is regarded as a restricted case of another type of mechanics where all p sub i are independent. The case in which the coordinates in the space of events are Galilean, and there are no electromagnetic and gravitational fields is examined. Author

N71-30342# California Univ., Berkeley. Lawrence Radiation Lab.

RADIATIVE LIFETIME OF THE 2 1S0 METASTABLE STATE OF HLEIUM

Robert Spaulding Van Dyck, Jr. (Ph.D. Thesis) 20 Nov. 1970 107 p refs

(Contract W-7405-eng-48)

(UCRL-20142) Avail: NTIS

After passing from a cooled source, helium atoms are excited to the 2 1S0 state by a pulsed electron gun. The atomic beam then contains primarily ground state helium atoms and metastable atoms in both the 2 3S1 and the 2 1S0 excited states. The time of flight spectrum for the metastable 2 1S0 state can be separated from the 2 3S1 state by using an RF discharge helium lamp. The 2 1 S0 state is quenched by absorption of a 20,518 A photon, raising the atom to the 2 1P1 state, which then decays preferentially to the 1S0 ground state; the 2 3S1 state remains unaffected. The time of flight spectrum for the 2 1S0 atoms is obtained from the difference between the full beam and the quenched beam. The metastable atoms are detected at two positions by Auger ejection of an electron from a copper target, the first of which is 60% mesh. A comparison of the number of metastables within a given velocity interval at the two detectors determines the number that decay in flight and yields a value for the two photon radioactive lifetime. The final value for the singlet lifetime is 20.2 + or − 1.0 msec. Author (NSA)

N71-30343# Argonne National Lab., Ill.

[NUCLEAR PHYSICS RESEARCH] Summary Report, Apr. – Sep. 1970

1970 86 p refs

(Contract W-31-109-eng-38)

(ANL-7739) Avail: NTIS

Research progress at the Physics Division in the period April through September 1970, is summarized. NSA

N71-30353 National Lending Library for Science and Technology, Boston Spa (England).

PARTICLE SIZE DETERMINATION USING THE COULTER COUNTER

P. Hackenberg 18 Sep. 1970 11 p refs Transl. into ENGLISH from Tonind-Zt. (West Germany), v. 92, no. 12, 1968 p 482 – 487

(NLL-Trans-5196) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A calibration procedure for the Coulter counter is described, whereby the effects of particle shape are allowed for in the calibration factor. Calibration is effected on a fraction of the raw material under investigation. The procedure likewise enables the proportion of the granular material not accounted for by the Coulter counter to be determined exactly. The precise determination of the particle size distribution becomes possible even with materials whose finest fractions cannot be accounted for by the Coulter counter. Results achieved with this procedure are discussed and compared with the calibration with spheres of known diameter. Author

N71-30354# Syracuse Univ., N.Y. Dept. of Physics.

NULL PLANE FIELD THEORY

F. Rohrlich [1970] 42 p refs Presented at the Intern. Universitatswochen fuer Kern Physik, Schladming, Austria, Mar. 1971

Avail: NTIS

A coherent and logically consistent introduction to the null plane field theory is presented starting from the first principles based on classical and quantum mechanics. Invariant null plane coordinatization, the classical initial value problem, classical scalar field theory, scalar null plane quantum field theory, and null plane quantum electrodynamics are discussed. J.M.

N71-30359# Virginia Univ., Charlottesville. Dept. of Physics.

PRECISION NEUTRON TRANSMISSION AND ENERGY MEASUREMENT BY TIME-OF-FLIGHT

D. F. Simmons (Champion Spark Plug Co.), D. S. Cramer (GE Co., Schenectady, N.Y.), and L. Cranberg [1970] 7 p refs Sponsored in part by NSF

Avail: Issuing Activity

A value for sigma of 5.956 b + or − 0.24% was determined at a mean neutron energy of 526.0 + or − 1.3 kev, corresponding to a singlet effective range of 2.95 + or − 0.12 fermis. Time-of-flight technique was used for the high signal-background ratio and high count rate in the determination of the sample transmission, with a small correction for in-scattering. Time-of-flight techniques were also used to determine the mean neutron energy. Author

N71-30363# Forskningradens Lab., Studuik (Sweden).

[NUCLEAR PHYSICS, CHEMISTRY, AND MEDICINE] Progress Report, 1969

Per-Olof Kinell, ed. 1970 62 p
(NP-18571; LF-27) Avail: AEC Depository Libraries

A summary is given of the current research projects at the Swedish Research Councils' Laboratory, in close proximity to the materials testing reactor R2 at the research establishment of AB Atomenergi, Studsvik, Nykoping. Physical, chemical, medical, biological, and technical applications of high intensity neutron fluxes, short-lived radioactive isotopes, and high-intensity radiation sources are reviewed. NSA

N71-30364 Wisconsin Univ., Madison.
LOW ENERGY THEOREMS FOR COMPTON SCATTERING OFF ARBITRARY SPIN TARGETS
Satoru Saito (Ph.D. Thesis) 1969 121 p
Avail: Univ. Microfilms Order No. 70-3688

Low energy theorems for Compton scattering on targets with arbitrary spin are studied. The scattering amplitude is dominated at threshold by the Born term, which we calculate explicitly. Other contributions at threshold are uniquely determined by requiring that the total amplitude be gauge invariant. In this way, each intrinsic electromagnetic moment of the target is obtained in terms of the threshold value of the amplitude. To linear order in omega (photon frequency) this information completely determines the amplitude and gives us a generalization to the arbitrary spin case of the low energy theorem of Low, Gell-Mann and Goldberger. It is found that two structure dependent parameters (electric and magnetic polarizabilities of the target) are necessary to describe the spin nonflip amplitude to order sq omega. It is necessary to introduce two additional parameters to completely determine the total amplitude to this order in omega. Dissert. Abstr.

N71-30369# Maryland Univ., College Park. Center for Theoretical Physics.
ON THE VIOLATION OF THE ABSOLUTE I VECTOR EQUALS 1/2 RULE IN THE K SUB l3 DECAYS
S. Oneda, H. Yabuki, and Seisaku Matsuda (Polytechnic Inst. of Brooklyn, N.Y.) May 1971 24 p refs
(Grant NSF GP-8748)
(TR-71-112) Avail: NTIS

The effect of broken symmetry on weak hadron currents is taken into account by applying the hypothesis of asymptotic SU(3) and SU(2) symmetries. No assumption is made about the mechanism of the SU(3) and SU(2) breakings except that both of them belong to an octet. The main effect turns out to be described essentially by the effect of the particle mixings which take place among the neutral pions, neutral eta mesons, and neutral eta'(958) mesons. It is shown that one of the solutions of these mixing parameters which are compatible with the SU(3) and SU(2) mass splittings between the pseudoscalar nonet, gives rise to a rather sizable violation of the rule in the branching ratios and, in particular, the sign of the violation is opposite to the one obtained by the usual consideration of the electromagnetic correction involving charged leptons. A remark is also added on the semileptonic baryon processes in broken SU(3) and SU(2) symmetries. Author

N71-30370# Stanford Univ., Calif. Dept. of Materials Science.
COMMENTS ON HOMOGENEOUS NUCLEATION THEORY
Kazumi Nishioka, Jens-Lothe (Blindern Univ., Oslo, Norway), J. P. Hirth (Ohio State Univ., Columbus), and G. M. Pound [1970] 18 p refs Submitted for publication
(Grant NSF GK-2159)
(SU-DMS-70-T-56) Avail: Issuing Activity

Reiss, Katz, and Cohen's theory for homogeneous nucleation of liquid from vapor is reformulated by using the criticism of Lothe and Pound. It is concluded that P(o) in Reiss, Katz, and Cohen's result has to be replaced by 1/volume sub cell. This gives a metastable equilibrium concentration of critical clusters 100 to 100,000 times larger than that predicted by Reiss, Katz, and Cohen for a typical case. The effect has to do only with translation; the contribution from rotation of the cluster is still wholly ignored. Author

N71-30371# Tokyo Univ. of Education (Japan). Dept. of Physics.
PHYSICAL AND SPURIOUS STATES IN THE DUAL RESONANCE MODEL
Masakatsu Kenmoku and Mitsuru Yamada Apr. 1971 31 p refs
(TUEP-71-18) Avail: NTIS

Physical states of each mass level of the dual resonance amplitudes are completely characterized. It is shown that there exist six particles with positive metric and only one particle with negative metric at each level on the second daughter trajectory. Some geometric properties of the projection operators are studied. The investigations are made throughout for general cases where alpha(0)<0. Author

N71-30375# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
SINGLE CRYSTAL FILTERS OF THERMAL NEUTRONS
P. Mikula, R. Michalec, B. Chalupa, L. Sedlakova, and J. Dvorak [1970] 12 p refs
(UJV-2488-F) Avail: AEC Depository Libraries

The possibility of using single crystal bismuth and silicon filters supported by the experimental results of the transmission of neutrons in the wavelength region from 0.30 – 1.77 A is discussed. Author (NSA)

N71-30377 Washington Univ., Seattle.
HIGHLY INELASTIC SCATTERING OF MEDIUM ENERGY He 3 AND He 4 PARTICLES BY HEAVY NUCLEI
Gary Milo Chenevert (Ph.D. Thesis) 1969 221 p
Avail: Univ. Microfilms Order No. 70-14742

The energy spectra of He-3 and He-4 particles emitted by heavy nuclei (Sn, Ta, Pt, Au and Pb) when bombarded by 50 and 75 MeV He-3 particles and 42, 50, 65 and 90 MeV He-4 particles were measured. Emphasized in the experiment were the inelastic scattering reactions (He-3, He-3 prime) and (alpha, alpha prime) however, data were also obtained for the transfer (He-3,alpha) and (alpha,He-3). Using a semiconductor detector telescope in conjunction with a Goulding particle identifier, the helium ions were detected and identified in the energy range from the energy of the Coulomb barrier for the emitted particles to that of the ground state. In the energy spectrum (at angles less that 50 deg) a broad prominent structure between 9 and 32 MeV excitation is seen and the He-4 spectra have a greater proportion of low energy particles than do the He-3 spectra. Dissert. Abstr.

N71-30378 Michigan Univ., Ann Arbor.
A MEASUREMENT OF THE 2 2S1/2-2 2P3/2 ENERGY SEPARATION, (DELTA E-S), IN HYDROGEN (n EQUALS 2)
Tong Wha Shyn (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms Order No. 70-14842

The 2S1/2-2P3/2 energy separation in the n=2 state of atomic hydrogen was measured by an atomic beam radio frequency method. Measurements of the frequencies of the rf field used to drive the transitions and the magnetic fields at the line centers of the resonance curves along with the theory of Zeeman splitting were used to determine the zero field splitting energy separation. Our final value of the energy separation is 9911.250 + or – 0.063 MHz where the quoted uncertainty is one average deviation from the mean. Using the average of the Lamb and Robiscoe experimental values of the Lamb shift, SH = 1057.82(10) MHz, we obtain Delta E = (10969.070 + or – 0.163) MHz. Dissert. Abstr.

N71-30383# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THREE GRAPHS IN THE YANG-MILLS THEORY

E. A. Ivanov 1971 21 p refs In RUSSIAN
(JINR-P2-5616) Avail: AEC Depository Libraries

The tree graphs are considered in the massless Yang–Mills field theory and in the ordinary massive Yang–Mills field theory. In the case of massless theory they are proved to be invariant on the physical subspace with respect to the c-number gradient variations of field and pairings and therefore coincide with the tree part of the S-matrix in the radiative gauge. It is shown that the internal lines of the tree diagrams of massive theory have no singularities in mass. The transition to zero mass in these diagrams is briefly discussed. Author (NSA)

N71-30384# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

SLOW COLLISIONS IN THE SYSTEM OF THREE BODIES INTERACTING ACCORDING TO THE COULOMB LAW

A. V. Matveenko and L. I. Ponomarev 1971 27 p refs In RUSSIAN
(JINR-P4-5608) Avail: AEC Depository Libraries

A general approach to the solution of the problem of slow collisions in a system of three bodies interacting according to the Coulomb law is formulated. The perturbed stationary state method, i.e., expansion of the solutions of the Schroedinger equation for the three-body problem according to eigenfunctions of the two-center problem in quantum mechanics, is used. The technique described makes possible the formulation and solution of a number of the problems of atomic and mesoatomic physics. Author (NSA)

N71-30385# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

ON THE FAST PION-MESON SCATTERING BY NUCLEI

A. G. Sitenko, I. S. Dotsenko, and A. D. Fursa 1970 15 p refs In RUSSIAN; ENGLISH summary
(ITF-70-71) Avail: AEC Depository Libraries

The fast pion-meson scattering by nuclei is considered on the basis of a multipole formalism. The impulse approximation is used. The amplitude of the pion-nucleon interaction is chosen according to the experimental data on the pion-meson scattering on free nucleons. The numerical calculations of angular distributions of the elastic scattering of negative pion-mesons on nuclei C-12 are carried out as well as the inelastic scattering of negative pion-mesons with the excitation level 2(+)T = D/gamma, gamma gamma MeV of nucleus C-12. A good agreement with experimental data in a wide interval of energies is obtained. Author (NSA)

N71-30386# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Kernphysik.

Ge(Li)-NaI(Tl) PAIR SPECTROMETER [GE(LI)-NAJ(TL) PAARSPEKTROMETER]

H. Hanle, K. Stelzer, M. Koriath, and H. Krueger Sep. 1970 37 p refs In GERMAN
(IKF-26) Avail: AEC Depository Libraries

By the use of a pair spectrometer the complex spectra of high energy gamma-rays can be simplified appreciably. The pair spectrometer described in this report consists of a small Ge(Li)-detector and an NaI(Tl)-annulus which is divided into four equal sectors. The annulus has a length of 12.5 cm and an outer diameter of 16.5 cm. The performance of this spectrometer has been investigated with sources of Na-24 and Ra-226 in different combinations of the sectors. Author (NSA)

N71-30387# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.

PRODUCTION OF LOW MOMENTUM NEGATIVE PARTICLES BY 70 GeV PROTONS

Yu. M. Antipov, N. K. Vishnevskii, and Yu. P. Gorin et al 1970 10 p refs In RUSSIAN
(IFVE-SEF-70-38) Avail: AEC Depository Libraries

The yields of negative pions, kaons, antiprotons, and antideuterons, produced by 70 GeV protons on Al and Be nuclei at the momenta 10 and 13.3 GeV/c were measured. Gas Cherenkov counters and time-of-flight spectrometers were used for particle identification. Author (NSA)

N71-30388# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

CALCULATION OF THE BINDING ENERGY AND THE WAVE FUNCTION OF He 3 BY THE HARMONIC POLYNOMIAL METHOD

V. P. Kharchenko and V. E. Kuzmichev 1970 28 p refs
(ITF-70-51-E) Avail: AEC Depository Libraries

The problem of the bound state of the system consisting of two protons and one neutron with the central interaction between nucleons is considered in the approximation using the expansion of the wave function in terms of the harmonic polynomials. The Coulomb interaction between nucleons, which causes the state with isospin T = 3/2 to be admixed into the He(3) wave function, is taken into consideration. For the expansion coefficients the set of coupled differential equations is obtained. In the approximation taking into account the harmonics with K = 0 and 2, the binding energy and the wave functions of He(3) are calculated for the square-well potential. On the basis of the wave function obtained, the values for the probabilities of the S prime states with T = 1/2 and with T = 3/2, the electromagnetic form factors, and the root-mean-square radii are obtained. Calculations are also done for H(3). Author (NSA)

N71-30393 Syracuse Univ., N.Y.

THREE REVERSED SPIN BOUND STATES IN THE HEISENBERG MODEL OF A FERROMAGNETIC SPIN SYSTEM

Peter John Millet (Ph.D. Thesis) 1969 146 p
Avail: Univ. Microfilms Order No. 70-12796

It is known that, in a one, two, or three dimensional ferromagnetic system of localized spins described by the Heisenberg model, states occur in which two reversed spins in an otherwise aligned system are bound to one another, that is, localized relative to one another, but not with respect to any specific lattice site. The problem of whether such bound states exist in the subspace of three reversed spins was investigated. In order to display some complicating features which are peculiar to this problem, the two reversed spin subspace is discussed. The methods described in the two reversed spin case are applied to three reversed spins and the wave equation for the amplitudes in the reversed spin basis is derived. In one dimension the final equation is a linear integral equation for a function of a single variable. Numerical analysis shows that bound states also exist in the two dimensional case. For three dimensions, the results indicate that bound states must be very close to the spin wave continuum if they exist at all. Dissert. Abstr.

N71-30395# Washington Univ., Seattle.

NUCLEAR PHYSICS LABORATORY Annual Report, 1970

Jun. 1970 173 p refs
(Contract AT(45-1)-1388)
(RLO-1388-121) Avail: NTIS

Nuclear structure and nuclear reaction research performed with a three stage tandem Van de Graaff accelerator and a conventional cyclotron is reported. The areas of investigation include the following: improvements in accelerator equipment, instrumentation, detector systems, and computer systems; and research in light nuclei, angular correlations, elastic and inelastic scattering, nucleon transfer reaction, photons from nuclear reactions, nuclear fission, and other nuclear processes. N.E.N.

N71-30398# Lund Univ. (Sweden). Dept. of Physics.

CALCULATIONS OF MESONIC CONTRIBUTIONS TO THE (GAMMA, n) REACTION

G. Andersson, B. Forkman, and B. Friberg Sep. 1970 44 p refs

(LUNP-7010) Avail: AEC Depository Libraries

The contribution to the (gamma, n)-reaction from the photo-pion production process was calculated for some light nuclei using a simple nuclear model. The result is in good agreement with experimental measurements. Author (NSA)

N71-30399# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

OBTAINING THE LIMITING RELATIONS FOR CORRELATION AVERAGES

N. N. Jr. Bogolyubov 1970 13 p refs In RUSSIAN; ENGLISH summary

(ITF-70-59) Avail: AEC Depository Libraries

The theorems necessary for obtaining many-time correlation averages are formulated under some rather general auxiliary conditions. The technique proposed is valid for a wide class of model systems with four-fermion interaction. Author (NSA)

N71-30400# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

DISPERSION-THEORETIC MODEL OF piN-SCATTERING BACKWARD PEAKS

A. I. Lendel and V. I. Lendel 1970 15 p refs

(ITF-70-65) Avail: AEC Depository Libraries

The structure of backward differential cross section of pion N scattering is explained by using the backward dispersion relations for the real part of pion + or − N scattering amplitude. Excellent agreement of the proposed model with the experiment is obtained. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-29201# Argonne National Lab., Ill.

CONVERSION OF URANIUM DIOXIDE TO URANIUM CARBIDE IN AN INDUCTION PLASMA TORCH REACTOR

D. Ramaswami, J. Pavlik, and A. A. Jonke Aug. 1970 35 p refs

(Contract W-31-109-eng-38)

(ANL-7671) Avail: NTIS

Exploratory studies were conducted to determine the feasibility of using an induction plasma torch reactor for converting uranium dioxide-graphite powder agglomerates to uranium carbide spheres. The agglomerates were fed continuously into the tail flame of a 25-kW induction plasma torch pointed downward. The solid particles were entrained by the tail flame and were directed into a product receiver, where they were separated from the gas stream. About 20% of the particles in the product were shiny (with metallic luster) black spheres of 25 to 50 millimicrons. The remainder of the particles had shapes similar to those of feed particles, with some rounding off of sharp corners. Author (NSA)

N71-29429# Wisconsin Univ., Madison.

BIT PUSHING AND DISTRIBUTION PUSHING TECHNIQUES FOR THE SOLUTION OF THE VLASOV EQUATION

K. R. Symon, D. Marshall, and K. W. Li Oct. 1970 60 p refs Presented at the 4th Conf. on Numerical Simulation of Plasmas, Washington, D.C., 2 - 3 Nov. 1970 Supported by AEC

(COO-1726-68; CONF-701113-7) Avail: NTIS

In a bit pushing program a plasma is simulated by manipulating a pattern of bits in the computer memory representing the pattern of particles in phase space. The method is analyzed and compared with conventional particle pushing techniques. In a distribution-pushing program the particle distribution function is modified according to the leap frog equations of motion for the particles. Algorisms are developed for accuracy and efficiency. Sample results of both kinds of programs are presented. Results are presented from a one-and-one-half-dimensional distribution pushing program simulating a plasma beam emerging from a circular hole. Author (NSA)

N71-29673# Institut Franco-Allemand de Recherches, St. Louis (France).

NUMERICAL AND EXPERIMENTAL STUDY OF LIGHT SCATTERING BY PLANE SHOCK WAVES [NUMERISCHE UND EXPERIMENTELLE UNTERSUCHUNG DER LICHTBEUGUNG AN EBENEN STOSSWELLEN]

H. J. Pfeifer, H. D. vom Stein, and B. Koch 13 May 1970 19 p refs In GERMAN

(ISL-T-20/70) Avail: NTIS

A numerical method based on the Huygens-Fresnel principle is used for the calculation of light scattered in amplitude and phase. The accuracy of the method is evaluated by comparison with known scattering diagrams. The theory is then applied to the analysis of a low intensity plane shock wave. The comparison of the computed intensity distribution with the experimental one leads to an accurate determination of the density step in the shock front and its velocity. The method seems suitable for studying the structure of shock fronts. ESRO

N71-29675# Princeton Univ., N.J. Plasma Physics Lab.

TENSOR-PRESSURE FLUID SIMULATION OF AN MHD PLASMA

E. Bowers and N. Winsor Nov. 1970 26 p refs Presented at the 4th Conf. on Numerical Simulation of Plasmas, Washington, D.C., 2 - 3 Nov. 1970

(Contract AT(30-1)-1238)

(MATT-814; CONF-701113-5) Avail: NTIS

A one-fluid model of a low pressure plasma in a toroidal geometry is presented. For laboratory parameters, it demonstrates the existence of shock structure in the presence of resistivity and viscosity leading to containment times on the order of milliseconds. The model computes the time evolution on a two-dimensional mesh of the plasma density, potential, and three-velocity and current components. The momentum equation includes the effects of bulk viscosity and gyroviscous stress. The generalized Ohm's law contains the resistive, Hall, and electron-pressure terms. The time step can be taken large enough (on the order of 1 microsecond for the stellarator case) for simulations comparable to a complete laboratory experiment to be performed in a reasonable amount of computer time (about 20 minutes of 360/91 time). Mathematically, the equations are in integro-differential form. A linear stability criterion is presented for the sum-difference formulations of these equations. Author (NSA)

N71-29820# Leeds Univ. (England). Dept. of Electrical and Electronic Engineering.

ASPECT OF ELECTRIC STRENGTH OF A MOVING GAS

A. E. D. Heylen Repr. from Proc. IEEE, v. 116, no. 12, Dec. 1969 p 2101 - 2104 refs

(Contract F61052-68-C-0013)

(AD-722312; AFCRL-71-0109) Avail: NTIS CSCL 20/9

The influence on the prebreakdown processes and the sparking voltage of a gas moving at an angle to an electric field across a uniformly stressed gap is considered quantitatively by invoking the equivalent-pressure concept. The velocity with which a moving gas displaces the charged particles taking part in the processes leading to a spark is found, and the variation of the gap strength with the gas flow is calculated. With a pure cross gas flow, no change in the electric strength is predicted, and this is in agreement with experiment where gas speeds up to 2,000 m/sec have been attained. With axial gas flow, the moving gas can either increase or decrease the gap strength depending on the direction of the gas flow relative to the field due to the direct applied voltage and

provided the gas speed is comparable in magnitude with the electron drift velocity (under a.c. conditions, a reduction in strength always occurs). A novel method for obtaining the electron drift velocity, and hence the electron-molecule-collision frequency, by the use of a moving gas is evolved. The analogy between a moving gas and an applied crossed magnetic field is pointed out. This leads to a second method for obtaining the electron drift velocity by the simultaneous application of a moving gas and a crossed magnetic field. Possible relevance to compressed-air-blast circuit breakers is considered. Author (GRA)

N71-29630# Princeton Univ., N.J. Plasma Physics Lab.
ANOMALOUS HEATING OF PLASMAS BY LASER IRRADIATION
P. Kaw, J. Dawson, W. Kruer, C. Oberman, and E. Valeo Dec. 1970 26 p refs Presented at the Intern. Conf. on Laser Produced Plasmas, Moscow, Nov. 1970
(Contract AT(30-1)-1238)
(MATT-817; CONF-701122-1) Avail: NTIS

When an intense electric field oscillating near the electron plasma frequency is applied to a plasma, it excites parametric instabilities that drive up the ion density fluctuations. The presence of moderate ion density fluctuations leads to a strong enhancement of the high frequency resistivity around the plasma frequency and hence to anomalous plasma heating. The enhancement of the resistivity, which can be physically attributed to a collective process involving the conversion of the electromagnetic wave energy into longitudinal plasma waves by a resonant-mode coupling process involving the ion waves, can typically be many orders of magnitude. The existence of such an effect is shown. A semiquantitative theory to explain the laboratory and computer experiments is also presented. Author (NSA)

N71-29661# Princeton Univ., N.J. Plasma Physics Lab.
IGNITION OF TOROIDAL FUSION REACTORS
R. G. Mills Nov. 1970 15 p refs Presented at the 5th Ann. Intersoc. Energy Conversion Eng. Conf., Las Vegas, 21 - 25 Sep. 1970
(Contract AT(30-1)-1238)
(MATT-800; CONF-700912-11) Avail: NTIS

Although numerous methods of adding energy to laboratory plasmas have been demonstrated, there are severe difficulties with almost all of them when considered for ignition of a practical reactor. Plasma confinement experiments in Tokamak machines have demonstrated striking improvements in achievable density-confinement time products. This has stimulated considerable optimism for the future for this particular form of hypothetical reactor. It has further been realized recently that the Tokamak is peculiarly suitable for a single compressional heating cycle that should achieve ignition in a straightforward manner that is easily generalized to practical reactor configurations. Author (NSA)

N71-29740# Princeton Univ., N.J. Plasma Physics Lab.
CHOICE OF GRIDS IN LOW-BETA FLUID COMPUTATIONS
N. K. Winsor and E. C. Bowers Jan. 1971 43 p refs Presented at the 4th Conf. on Numerical Simulation of Plasmas, Washington, D.C., 2 - 3 Nov. 1970
(Contract AT(30-1)-1238)
(MATT-822; CONF-701113-6) Avail: NTIS

When the magnetic stress is large compared to the plasma pressure, the magnetic field geometry controls the plasma behavior. For finite difference calculations of this behavior, the grid should be chosen to fit the geometry. Three coordinate systems are presented, and their relative merits are compared. Some general techniques for a low beta simulation (in particular, the conservation law form of the equations and the symbolic style of programming) are discussed and recommended. A proposed simulation of the adiabatic toroidal compression experiment is used as an illustration of the advantages of writing a fluid code in curvilinear coordinates. Author (NSA)

N71-29902# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
STARK EFFECT IN A TURBULENT PLASMA OF RF DISCHARGE IN OMEGA DEVICE
A. B. Berezin, L. V. Dubovoi, and B. V. Lublin 1970 7 p refs
(NP-18532) Avail: AEC Depository Libraries

Profile measurements were made of H alpha, H beta, and H gamma spectral lines in a plasma of a powerful hf discharge. In those conditions, when ion sound instability takes place, abnormally large broadening of H beta and H gamma lines is found for measurements in a perpendicular direction to discharge field. The strength of a longitudinal component of the microturbulence field is evaluated. In experiments with longitudinal component is approximately greater than 1 keV/cm, strong anisotropy of the turbulence field, corresponding to longitude $>>$ E tranverse is found. Author (NSA)

N71-30053# Electricity Council Research Center, Capenhurst (England).
NEW TECHNIQUE FOR MEASURING THE TEMPERATURE OF LTE PLASMAS
P. D. Johnston Jul. 1970 13 p refs
(ECRC/N-288) Avail: AEC Depository Libraries

A method of defining the temperature at a given point in a discharge by means of a maximum in a ratio of measureable quantities and relating other ratios to this maximum is described. Measurements of the continuum velocity across the discharge and the intensity of a hydrogen line are all that is required. Both the line intensity and the continuum intensity can be converted, in the case of an inhomogeneous circularly symmetric discharge, from observed integrated profiles to radial profiles by an Abel inversion technique. The advantages of this method are: no knowledge of either the transition probability or the spectral band width is required; enough continuum intensity can be accepted by the detector to provide a good signal to noise ratio; and no calibration whatsoever is involved. NSA

N71-30134 Ohio State Univ., Columbus.
DENSE PLASMA FOCUS FORMATION BY DISK SYMMETRY
Robert Allen Buckwald (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms Order No. 70-13990

Using a disk-shaped discharge chamber, a plasma focus has been produced at times ranging from 15 to 3.5 microseconds after the beginning of the discharge. The exact time depends on pressure. The focus had a density of greater than 10 to the 18th power ions/ccm and a temperature of approximately 10 to the 60th power K. Contrary to indications from the dense plasma focus device, no difficulty was observed in focussing the device. Focus durations as long as 2.0 microseconds were obtained. Two simple models explain the discharge phenomena. First, the snow plow model was seen to explain the compression and gave an order of magnitude estimate for collapse speeds observed in the disk focus device. Second, a simple ionization and avalanche model explained the time dependent delays in starting the discharge. Dissert. Abstr.

N71-30193# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT Monthly Progress Report, 1 Jul. - 31 Dec. 1970
31 Dec. 1970 11 p refs
(NP-18663; MPR-20) Avail: AEC Depository Libraries

Research covering the following aspects of plasma physics is reviewed: (1) plasma sources; (2) hydromagnetic ionizing fronts; (3) hydromagnetic waves; (4) laser diagnostics; (5) plasma decay in the Sydney University Plasma Physics Experimental Rig (SUPPER); (6) electron cyclotron harmonic resonances in the 500-MHz to 2-GHz range of the SUPPER 5 discharge; (7) a performance study of the pulsed HCN laser at 337 microns and its dependence on the electrical discharge and other parameters. Recent research reports are also listed. Author (NSA)

N71-30194*# Scientific Translation Service, Santa Barbara, Calif.
MAGNETIC HYDRODYNAMICS OF PLANE FLOWS IN A PLASMA WITH ANISOTROPIC PRESSURE [MAGNITNAYA GIDRODINAMIKA PLOSKIKH TECHENIY V PLAZME S ANIZOTROPNYM DAVLENIYEM]
V. S. Baranov et al Washington NASA Jul. 1971 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, Nov.–Dec. 1970 p 3–10
(Contract NASw-2035)
(NASA-TT-F-13570) Avail: NTIS CSCL 20I

Hydrodynamic equations are used to analyze certain types of plane flows in a plasma with anisotropic pressure (pressure in the direction of the magnetic field is not equal to pressure in the direction normal to the magnetic field). The relations on the surfaces of strong discontinuity are used to study the variation of parameters in weak shock waves by linear approximation. Problems of flow past bodies that weakly perturb a homogeneous plasma flow at infinity are also studied by linear approximation. Author

N71-30195 Wisconsin Univ., Madison.
A CROSSED FIELD EXPERIMENT TO STUDY PLASMA FORMATION PROCESSES AND RESULTING GUIDE FIELD SPATIAL AND ENERGY DISTRIBUTIONS
Carroll Ross Harder (Ph.D. Thesis) 1969 150 p
Avail: Univ. Microfilms Order No. 70-3549

A crossed field plasma experiment was constructed to investigate the utility of the device as a source of plasma for thermonuclear research. The physics of plasma formation were investigated and the resulting plasma examined. The source was designed and constructed with special emphasis on the contouring of electrodes to constant flux surfaces in an attempt to reduce parallel electric and magnetic field components and plasma interaction with electrode surfaces. Source evolution is discussed with respect to efforts expended to eliminate or control shorting which still persists along with details of the plasma formation process. Source internal shorting mechanisms were studied with the conclusion that both downstream and upstream shorting paths exist. Plasma exiting phenomena are discussed, and with respect to axial acceleration mechanisms and the ion energy spectrum. Diamagnetic loop data are analyzed defining two classes of plasma by the axial acceleration mechanisms witnessed before and after spoke closure. These results were found to support a spoke model which, to an extent, successfully explained the ion-energy spectrum observed at the end of the guide field. Dissert. Abstr.

N71-30196 Michigan Univ., Ann Arbor.
ON THE SCATTERING OF LASER LIGHT BY HIGH DENSITY PLASMAS
Robert Anthony Schaefer (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms Order No. 70-14633

The scattering of photons by dense ionized gases is discussed theoretically, emphasizing that the predominant scattering process is the Thomson scattering of photons by the free electrons in the plasma. In the analysis particular care is taken to include the effects of all internal electromagnetic field fluctuations, and the transverse electric and magnetic fields are included in the kinetics equations. It is found that if the plasma is in thermal equilibrium and there is no applied electromagnetic field, the scattering cross-section for photons is completely independent of the transverse internal field fluctuations. However, if an electric current is flowing through the plasma and the current may be represented by an electron drift the plasma, a correction to the previously calculated scattering cross-section is found due to the internal transverse field fluctuations. This correction may be of sizeable magnitude under certain experimental conditions. It is concluded that, for the diagnosis of a dense plasma by the laser light scattering technique, the internal transverse field fluctuations must be considered or their neglect must be justified. Dissert. Abstr.

N71-30240*# Paris Univ., Orsay (France). Lab. de Physique des Plasmas.
GAS PRESSURE AND ELECTRON DENSITY IN THE ACTIVE ZONE LEVEL OF HOLLOW CATHODE ARC DISCHARGES [LA PRESSION DU GAZ ET LA DENSITE DES ELECTRONS AU NIVEAU DE LA ZONE ACTIVE DES DECHARGES D'ARC A CATHODE CREUSE]
Habibollah Minoo Nov. 1970 15 p refs In FRENCH; ENGLISH summary
(NP-18708; LP-119) Avail: AEC Depository Libraries

After an experimental study of the pressure variations at the active zone (A.Z.) level as functions of different discharge parameters, a simplified model is proposed for the longitudinal variations of the partial pressures of electrons, ions and neutrals inside the cathode tube. According to this model, electron and neutral pressures undergo very important variation at the A.Z. level. Author

N71-30326*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
PULSED ELECTROMAGNETIC GAS ACCELERATION Semiannual Report, 1 Jul.–31 Dec. 1970
Robert G. Jahn Jan. 1971 98 p refs
(Grant NGL-31-001-005)
(NASA-CR-119171; SAR-634p) Avail: NTIS CSCL 20I

Detailed experimental mapping of the potential and current distributions throughout the discharge chamber of quasi-steady MPD arc indicates that the anode fall voltage varies inversely with local anode current density, over a large range of arc currents and mass flow rates. The corresponding anode power loss is found to drop from about 50% to 10% at the power is increased from 1 to 10 megawatts. In an associated study in a parallel-plate accelerator, where expansion of the flow beyond the discharge region is precluded by the one-dimensional geometry, low exhaust speeds and high downstream temperatures are observed, which yield information on the energy deposition ratio within the arc. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-29470*# Brookhaven National Lab., Upton, N.Y. Instrumentation Div.
WORK ON GAMMA COMPENSATED AND HIGH-PURITY GERMANIUM RADIATION DETECTORS Summary Report, 1 Jan.–31 Dec. 1970
J. Llacer [1970] 26 p Sponsored by AEC
(BNL-15643) Avail: NTIS

Research on the compensation of n-type germanium by gamma radiation is reported. Hall effect measurements and their interpretation; the process of making p(+) and n(+) contacts on medium and high purity germanium; measurements on completed gamma-compensated and high-purity devices; and a mathematical model of a junction with deep acceptor levels are discussed. NSA

N71-29641*# Massachusetts Inst. of Tech., Cambridge. National Magnet Lab.
RESEARCH ON INSTABILITY IN SUPERCONDUCTING MAGNETS Final Report
Benjamin Lax Dec. 1970 9 p refs
(Contract AT(30-1)-3700)
(MIT-3700-14) Avail: NTIS

Experimental techniques and computer-aided analytic studies

undertaken together as a broad-based effort to investigate instabilities in high-field superconducting wires and ribbons are described. The laboratory work centered around the initiation of an instability in a superconducting sample under a variety of carefully devised, known environmental conditions. The analytic portion of the program was a realistic computer simulation of the behavior of a superconductor in a coil environment. Comparisons among the results of the two parts of the program were not only helpful in themselves, but also helped to indicate some possible aides in controlling the instabilities. Author (NSA)

N71-29642# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

A STATISTICAL THEORY OF AVALANCHE BREAKDOWN IN SILICON

T. V. Sewards and W. W. Grannemann Apr. 1971 83 p refs

(Contract N00014-68-A-0158)

(AD-722369; EE-184(71)ONR-005) Avail: NTIS CSCL 20/12

A statistical theory of avalanche breakdown in silicon is presented, based on the conventional Boltzmann transport equation. The scattering mechanisms considered are impact ionization (electron-hole pair production), phonon emission and absorption, thermal generation and recombination. The resultant critical field is found to depend on the recombination statistics, which were ignored in previous theories of avalanche breakdown. The theoretical temperature dependence is compared with the temperature dependence of the breakdown voltages of three commercial diodes. Author (GRA)

N71-29643# Montana State Univ., Bozeman. Dept. of Physics.

PHOTOEMISSION AND OPTICAL STUDIES OF THE ELECTRONIC STRUCTURE OF SOLIDS Final Scientific Report, 1 Jan. 1968 - 31 Jan. 1971

Gerald J. Lapeyre Mar. 1971 10 p refs

(Grant AF-AFOSR-1450-68)

(AD-722069; AFOSR-TR-71-0919) Avail: NTIS CSCL 20/12

Ultraviolet photoemission spectroscopy and optical spectra was used to study the electron energy states, optical excitation processes, final state interactions, and hot electron scattering processes in metals, semi-metals, and nonmetals. Very thin films of alkaline earth metals have been used to control the photoemission threshold (work function). Author (GRA)

N71-29692# California Univ., Santa Cruz.

MICROWAVE AND OPTICAL SPECTROSCOPY OF MAGNETIC IONS IN CRYSTALS Final Report, 27 Jun. 1968 - 30 Sep. 1970

Peter L. Scott Apr. 1971 6 p refs

(Contract N00014-69-C-0200-7002)

(AD-722411) Avail: NTIS CSCL 20/12

The report describes the development of instrumentation for the investigation of the detailed nature of energy levels of impurity ions in crystalline solids used to investigate some of the detailed nature of the energy level scheme of exchange-coupled chromium ion pairs in ruby; to study some aspects of energy transfer between isolated chromium ions and pairs of chromium ions in ruby; and to observe the transfer of energy from one system to another by means of an energy-level crossing technique. Author (GRA)

N71-29693# Boeing Scientific Research Labs., Seattle, Wash.

COMPUTER SIMULATED ELECTRON DIFFRACTION CONTRAST

P. P. Gruner and A. K. Eikum Dec. 1970 69 p refs

(AD-722244; D1-82-1033) Avail: NTIS CSCL 20/2

A computer program yielding the intensity distribution of high-energy electrons that have passed through an absorbing crystal foil is developed for the two-beam case of the dynamical theory of diffraction. Tilted and untilted foils will be considered that contain one dislocation (perfect or partial) and up to three overlapping parallel stacking fault planes. Elastic anisotropy of the medium is taken into account. GRA

N71-29714# Technische Hogeschool, Eindhoven (Netherlands).

AN INVESTIGATION INTO THE STRUCTURE OF THE PARTICLES IN FINELY GROUND QUARTZ CRYSTALS [EEN ONDERZOEK NAAR DE STRUCTUUR VAN DE DEELTJES VAN FIJNGEMALEN KWARTS]

Kasper Koopmans (Ph.D. Thesis) 1971 147 p refs In DUTCH; ENGLISH summary

Avail: NTIS

The deformations in the crystal structure of small quartz particles depend on the particle sizes. The structures of particles with diameters between 0.5 × 0.0001 and 30 × 0.0001 cm are studied by X-ray diffraction. All Debye-Scherrer lines of a quartz powder with a mean particle size of about 0.7 × 0.0001 cm, even those in the front reflection region, show line broadening. The diffraction patterns of quartz powders with a mean particle size of about 1.5 × 0.0001 and 2.0 × 0.0001 show line broadening only in the high angle region. The deformed structures recover to a great extent by heat treatment at 1200 C. Powders having mean particle sizes of 14 × 0.0001 and 28 × 0.0001 cm show the effects of particle absorption and extinction by giving rise to smaller integrated intensities of the Debye-Scherrer lines. Author

N71-29723 Pennsylvania State Univ., University Park.

SPECTROSCOPIC PROPERTIES OF THE NATURAL SILICATE GARNETS

Raymond Kenworthy Moore (Ph.D. Thesis) 1969 175 p

Avail: Univ. Microfilms Order No. 70-13864

This study was undertaken to determine the spectral properties of the natural silicate garnets and the structural and chemical interpretations of the spectra. Spectra of 22 garnets have been obtained in the optical range 0.3 to 5.0 microns and to 300 microns in the infrared. Raman spectra for six of the samples have been obtained. Assignments of the observed bands in the optical spectra were made to Fe2(+), Fe3(+), Mn2(+), Cr3(+), and V3(+) and a determination of the site positions of these ions was made. The assignments of the bands to specific electronic transitions have been made for the majority of ions. Optical (0.3 to 2.7 microns) and infrared (to 300 microns) absorption spectra were measured on three high-titanium andradites. A full factor group analysis was applied to determine the number and selection rules of the normal modes of garnet. Infrared spectra to 300 microns to include all lattice bands and laser-source Raman spectroscopy were used to determine the frequencies of the modes. Dissert. Abstr.

N71-29725# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.

SINGLE CRYSTAL STUDIES OF HYDRATED TRANSITION METAL IONS BY ELECTRON PARAMAGNETIC RESONANCE

Akira Jindo (Ph.D. Thesis) Jan. 1971 229 p refs

(Contract W-7405-eng-48)

(UCRL-20386) Avail: NTIS

The electron paramagnetic resonance (EPR) of certain transition metal ions in hydrated single crystals at temperatures ranging from 300 to 1.2 K was investigated. The EPR spectra of Co2(+), Ni2(+), and Cu2(+) doped into single crystals of ZnSeO4-6H2O were studied. This diamagnetic crystal is isostructural with the tetragonal alpha-NiSO4-6H2O. The relationship between the principal spin Hamiltonian axes (x,y,z) and the crystallographic axes (a,b,c) has been established. The spin Hamiltonian parameters are found for Cu2(+), Ni2(+), and Co2(+). These parameters agree well with crystal field calculations for an elongated tetragonal symmetry, if some covalency is included. Author

N71-29735 Brown Univ., Providence, R.I.
MODULATION TECHNIQUES FOR STUDYING THE OPTICAL PROPERTIES OF SOLIDS
Kerry Lee Shaklee (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms Order No. 70-8790

The interband optical properties of several group 4, 3-5, 2-6, 4-4, and 1-7 semiconducting compounds are studied using optical modulation techniques. The electro-reflectance technique gives accurate values for the interband energy gaps and spin-orbit splittings of many group 4, 3-5, 2-6 compounds. Electroreflectance measurements at 77 K give a value of 0.07 eV for Delta sub 0 in GaP. Wavelength modulated reflectivity measurements on the E sub 1 and E sub 1 + Delta sub 1 transitions in InSb, HgTe and GaAs at 77 K indicate that hyperbolic excitons make a significant contribution to the dielectric constant. This data is compared with a hyperbolic exciton model which uses a Slater-Koster type exciton potential. A good qualitative comparison is obtained. Electroreflectance and thermoreflectance data support the interpretation of the wavelength modulated reflectivity spectra.
Dissert. Abstr.

N71-29737 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF DISLOCATIONS ON THE COARSENING OF PARTICLES
H. Kreye 2 Mar. 1971 13 p refs Transl. into ENGLISH from Z. Metallk. (West Germany), v. 61, no. 2, 1970 p 108-112
Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The theory of Lifshitz-Wagner on the coarsening of particles is enlarged for the case where diffusion along dislocations is a contributory factor. This leads to a change in particle growth according to mean particle radius and of the particle distribution. The results are discussed in terms of several examples: coarsening in a material deformed by pressure waves, coarsening in a rolled nickel-aluminium alloy, and in situ recrystallization.
Author

N71-29738# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
STUDY OF SLIP BAND GROWTH IN PRESTRAINED COPPER
Thomas H. Kosel (M.S. Thesis) Dec. 1970 42 p refs
(Contract W-7405-eng-48)
(UCRL-20372) Avail: NTIS

The formation of heavy slip bands in prestrained copper crystals was studied by transmission electron microscopy. Heavily damaged regions parallel to the primary slip plane were observed. These were found to correlate well in dimensions and distribution with slip bands observed in a previous surface investigation of crystals of the same geometry. The damaged regions consisted principally of dense carpets of dislocations lying on the primary glide plane. The observations are discussed in terms of a model which explains the formation of heavy slip bands.
Author

N71-29767# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
CREEP OF LITHIUM FLUORIDE SINGLE CRYSTALS AT ELEVATED TEMPERATURES
Donald R. Cropper (Ph.D. Thesis) Jan. 1971 56 p refs
(Contract W-7405-eng-48)
(UCRL-20350) Avail: NTIS

The creep deformation of lithium fluoride single crystals was studied in compression over the temperature range 650 to 750 C. Extended primary creep was observed for crystals deformed with the compression axis in <100> orientation; strains of 0.20 or more were required for the establishment of steady state conditions. Crystals with compression axes in the <111> direction reached steady state quickly, at strains of 0.05 or less. The steady state strain rate was found to be proportional to the stress raised to the power n, where n ranged from 3.1 for <111> crystals to 4.1 for <100> crystals. The activation energy for creep was determined to be 53 + or - 7 kcal/mole over the temperature range considered, regardless of crystal orientation or impurity content up to 300 ppm total impurities; this compares favorably with the activation energy for lattice diffusion of the fluorine ion in LiF. Well developed substructures were observed in the deformed crystals with the subgrain diameter varying inversely with the applied stress. These results suggest that the creep deformation of lithium fluoride single crystals may be similar to that for metals and is probably dependent upon the dislocation climb process.
Author

N71-29784# Aerospace Corp., El Segundo, Calif. Lab. Operations.
DISLOCATION ANALYSIS OF STRESS. VOLUME 1: BASIC CONCEPTS
James D. Buch 8 Mar. 1971 39 p refs
(Contract F04701-70-C-0059)
(AD-722432; TR-0059(6250-10)-3-Vol-1; SAMSO-TR-71-65-Vol-1) Avail: NTIS CSCL 20/12

It is shown that dislocation configurations in a continuum can be divided into two parts: (a) stress producing and (b) zero stress. The zero-stress parts can be described by arbitrary scalers, vectors, and antisymmetric tensors, and this formulation allows the deduction of the technique for determining the stress-producing part. Some aspects of the zero-stress dislocations and zero-stress-zero-force configurations are discussed relative to electron microscopy observations and high-temperature creep.
Author (GRA)

N71-29806 Illinois Univ., Urbana.
MICROSTAIN STUDY OF THE EFFECT OF SECONDARY SLIP IN STRAIN HARDENING OF COPPER SINGLE CRYSTALS
James Lankford, Jr. (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms Order No. 70-13386

From a large copper single crystal grown from the melt, tensile specimens having various crystallographic orientations were spark-machined. Following annealing and polishing, some of the crystals were tested in tension at a strain sensitivity of 5 x 10 to the minus 7th power, and at a temperature of 23 C. Work hardening parameters and recovered strain data were measured. Identical specimens were prestrained, irradiated with fast neutrons, sectioned on 111 planes, and etched to reveal the primary and cross plane dislocation densities and distributions. The initial microyielding were described by a two stage parabolic relation. The recovered strains plotted as a function of plastic prestrain were found to be essentially orientation independent. It was concluded that primary-forest dislocation interactions control the flow stress, that competition between primary-secondary dislocation segments account for the initial parabolic behavior, and that secondary slip and cell formation may occur in the absence of any internal stress due to classical pile-ups or tangles.
Dissert. Abstr.

N71-29837# California Univ., Los Angeles. Dept. of Physics.
ELECTRON SPIN RESONANCE IN DILUTE MAGNETIC ALLOYS
R. Orbach Aug. 1970 25 p refs
(Contract N00014-69-A-0200-4006)
(AD-722818) Avail: NTIS CSCL 20/12

A summary is given of the theory of electron paramagnetic resonance (ESR) in dilute magnetic alloys. The conditions for the existence of the so-called ESR bottleneck are precisely stated. The frequency and temperature dependent exchange relaxation rates between the localized and conduction electron spins are exhibited. It is shown that, at very low temperatures, the frequency dependence of these rates can be used to break the bottleneck on the low frequency side of the resonance line. This allows for a direct measurement of the exchange coupling in alloys which, at usual helium temperatures, would be strongly bottlenecked and not exhibit exchange widths or shifts. The effect of the ESR bottleneck on the hyperfine splitting of a localized moment in a metal is also discussed.
Author (GRA)

N71-29840# Florida Univ., Gainesville. Dept. of Electrical Engineering.
A CENTER OF COMPETENCE IN SOLID STATE MATERIALS AND DEVICES
Fred A. Lindholm, Arthur J. Brodersen, Eugene R. Chenette, Stephen W. Director, Robert W. Gould et al 10 Oct. 1970 325 p refs
(Contract F19628-68-C-0058; ARPA Order 1060)
(AD-722474; AFCRL-71-0030; SR-8) Avail: NTIS HC $6.00/MF $0.95 CSCL 20/12

Physical origins of burst noise in transistors. Noise in phototransistors and photodiodes Impurity concentration dependent density of states at the Fermi level Recombination and trapping of the photo-excited carriers in gold-doped silicon Unified modeling of field-effect devices Simultaneous automated ac and dc design of linear semiconductor integrated circuit amplifiers. The effect of crystallization on the strength of L-12 O - SI O-2 glass-ceramic. The early stages of crystallization in a L-12 O - S I O-2 glass. Electrical properties of glass. Solid solution decomposition of aluminum-rich aluminum-zinc-silver alloys. Metal tip holder for field-ion microscope. (GRA)

N71-29922*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR EVALUATION OF BLOCH-GRUENEISEN PARAMETERS OF METALS AND EVALUATION OF ELECTRICAL RESISTIVITY OF TANTALUM AS A FUNCTION OF TEMPERATURE
Thor T. Semler and John P. Riehl Washington Jul. 1971 27 p
(NASA-TM-X-2320; E-6242) Avail: NTIS CSCL 20L

A computer program has been written for the least squares evaluation of the parameters in the Bloch-Grueneisen relation for ideal electrical resistivity of metals. The program input is experimental measurements of resistivity and temperature. The constants associated with tantalum have been determined by using this code and several experimental measurements of the electrical resistivity of tantalum. Author

N71-29925*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF A THEORY OF THE SPECTRAL REFLECTANCE OF MINERALS, PART 2
J. R. Aronson, A. G. Emslie, L. H. Roach, P. F. Strong, and P. C. Von Thuna 1 Apr. 1971 90 p refs
(Contract NAS9-10875)
(NASA-CR-115057; ADL-C-72584-Pt-2) Avail: NTIS CSCL 20L

The theory of diffuse reflectance of particulate media is discussed. A more accurate calculation of the absorption loss in the particles was made and a factor allowing for interparticle contacts included. With these changes, reasonably good fits are obtained to experimental data for quartz, garnet, glass, corundum powders, and mixtures of these for particle sizes. The observed particle dependence is now qualitatively given by the theory. For fine particles a modified Lorentz-Lorenz theory that allows for the skin depth of the radiation was tried. It appears to indicate that clumping of the particles must be taken into account. Author

N71-29926# National Bureau of Standards, Washington, D.C. Metallurgy Div.
FUNDAMENTAL ASPECTS OF DISLOCATION THEORY, VOLUME 1
John A. Simmons, R. deWit, and R. Bullough, eds. Dec. 1970 725 p refs Conf. held at Gaithersburg, Md., 21 - 25 Apr. 1969
(NBS-SP-317-Vol-1) Avail: SOD $8.25

The papers presented pertain to discrete dislocations in continuum elasticity, lattice theories, dislocation-phonon interactions, applications of the geometry of dislocations, and intrinsic properties of dislocations. For individual titles, see N71-29927 through N71-29956.

N71-29927# Melbourne Univ., Parkville (Australia). Div. of Tribophysics.
DISCRETE DISLOCATIONS IN CONTINUUM ELASTICITY
A. K. Head *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 5-9 (See N71-29926 17-26)
Avail: SOD $8.25

The problem of the experimental determination of stacking fault energy is considered. Attention is restricted to those methods which observe and measure in the electron microscope a simple dislocation-stacking fault configuration. It is assumed that the configuration is in equilibrium with the forces between the dislocation balancing the surface tension of the stacking fault. Author

N71-29928# Oslo Univ. (Norway). Inst. of Physics.
THE IMAGE FORCE ON DISLOCATIONS AT FREE SURFACES: COMMENTS ON THE CONCEPT OF LINE TENSION
J. Lothe *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 11-22 refs (See N71-29926 17-26)
Avail: SOD $8.25

It is shown that a straight dislocation emerging at a planar free surface is acted upon by a force. How core energy terms may modify the results is discussed. It is concluded that also for nodes in the characteristic orientation for no elastic forces on the branches, some branch curvature will be present near the node. Author

N71-29929# Aktiebolaget Atomenergi, Studsvik (Sweden).
STABILITY AND SOME CHARACTERISTICS OF UNIFORMLY MOVING DISLOCATIONS
K. Malen *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 23-33 refs (See N71-29926 17-26)
Avail: SOD $8.25

The stability of uniformly moving dislocations was studied in the case of elastic anisotropy. The stress field around a uniformly moving dislocation was also investigated. Increasing the velocity of a dislocation corresponds to some extent to a change in the anisotropy of the crystal. Author

N71-29930# Liverpool Univ. (England). Dept. of Metallurgy and Materials Science.
THE DISLOCATION IN A SEMI-INFINITE ISOTROPIC MEDIUM
D. J. Bacon and P. P. Groves *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 35-45 refs (See N71-29926 17-26)
Avail: SOD $8.25

The displacement associated with an infinitesimal dislocation loop of arbitrary orientation in an isotropic, semi-infinite elastic medium was obtained, and on integration this yields the displacement associated with a finite dislocation loop. The solution for the infinitesimal loop was obtained by finding the relationship between point forces and displacement dipoles in an infinite medium, and using the same relations with Mindlin's solution for the point force in an elastic half-space. Preliminary results are presented for the forces on the loop sides and changes in loop energy on rotation for the situation in which the Burgers vector is normal to the surface. Author

N71-29931# Virginia Univ., Charlottesville. Dept. of Materials Science.
THEORETICAL CONSIDERATIONS ON THE EXTENSION OF 1/2(110), (111) DISLOCATIONS IN ISOTROPIC fcc METALS INTO SHOCKLEY PARTIALS
Doris Kuhlmann-Wilsdorf and T. R. Duncan (Wisconsin Univ., Madison) *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 47-55 refs Sponsored by AEC (See

N71-29926 17-26)
Avail: SOD $8.25

The energy changes and equilibrium separations associated with the extension of 1/2(110), /111/ dislocations in fcc metals into Shockley partials were calculated and were found considerably smaller than the values of Seeger and Schock. The maximum stress of repulsion between Schockley partials was estimated, as well as the energy gain due to dislocation splitting. Equilibrium separation, maximum repulsive stress, and energy gain was evaluated on the basis of a simple model. J.A.M.

N71-29932# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.
SCREW DISLOCATIONS IN INHOMOGENEOUS SOLIDS
G. P. Sendeckyj *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 57-69 refs (See N71-29926 17-26)
(Contract AF 33(615)-3110)
Avail: SOD $8.25

The problem of screw dislocations interacting with free surfaces and inhomogeneities is considered, and a general method is presented for solving a large class of screw dislocation problems. Results of antiplane deformation calculations and screw dislocation problems near curvilinear inclusions are reviewed using the appropriate mapping function. Screw dislocations near two circular inclusions and finite inclusions and in solids with plane boundaries are also investigated. J.A.M.

N71-29933# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
SUBSONIC, SUPERSONIC, AND TRANSONIC DISLOCATIONS MOVING ON AN INTERFACE SEPARATING TWO MEDIA OF DIFFERING ELASTIC PROPERTIES
H. M. Berg, J. E. Bloom, H. Ishii, R. H. Marion, D. E. Pease et al *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 71-87 refs Sponsored in part by ARPA (See N71-29926 17-26)
Avail: SOD $8.25

The problem of a dislocation moving on an interface separating two isotropic elastic media that have differing elastic constants and densities is examined. Solutions are found for moving screw dislocations, gliding edge dislocations, and climbing edge dislocations. The analysis is generalized that was used in a study of the elastic displacements and stress field of subsonic, transonic, and supersonic dislocations moving in an ordinary elastic medium. Author

N71-29934# National Bureau of Standards, Washington, D.C. Metallurgy Div.
INTERNAL STRESS AND THE INCOMPATIBILITY PROBLEM IN INFINITE ANISOTROPIC ELASTICITY
John A. Simmons and R. Bullough (United Kingdom Atomic Energy Authority, Harwell, Engl.) *In its* Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 89-124 refs (See N71-29926 17-26)
Avail: SOD $8.25

By integration of the projection operator for the internal distortion field, an alternative description for internal distortion fields in terms of dislocations is given. The Mura-Willis formula as well as the distortion field due to a rational dislocation element for an anisotropic body are obtained as integrals of the basic displacement dipole kernel for internal distortions. Integration of the displacement dipole kernel provides a description of the internal distortion field due to a rational incompatibility element. The general formula for the stress function due to an incompatibility distribution in a general infinite anisotropic body is given and shown to reduce to the formulation of Kroner for isotropic bodies. Explicit methods to compute kernels for internal distortions due to incompatibilities are discussed. Author

N71-29935# Ford Motor Co., Dearborn, Mich. Metallurgy Section.
SERIES REPRESENTATION OF THE ELASTIC GREEN'S TENSOR FOR CUBIC MEDIA
D. M. Barnett *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 125-134 refs (See N71-29926 17-26)
Avail: SOD $8.25

Two representations for the cubic Green's tensor components as power series in the anisotropy factor are developed, and first order corrections of anisotropy to the Green's tensor and to the interaction energy between two mechanical point defects are calculated. It is shown that the best successive approximation scheme is that which constructs the zeroth order (isotropic) approximation to the Green's tensor by identifying the Lame constants lambda and mu. Author

N71-29936# United States Steel Corp., Monroeville, Pa. Edgar C. Bain Lab for Fundamental Research.
SOME PROBLEMS INVOLVING LINEAR DISLOCATION ARRAYS
N. Loust *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 135-146 refs (See N71-29926 17-26)
Avail: SOD $8.25

Muskhelishvili's inversion formulas for singular integral equations is employed to deal with two types of problems. The distribution of dislocations in a double periodic array of screw pile-ups in an arbitrary stress field are considered. The second type is concerned with screw pile-ups terminating at phase boundaries, again for arbitrary stress fields. Author

N71-29937# Allied Chemical Corp., Morristown, N.J. Materials Research Center.
SOME RECENT RESULTS ON DISLOCATION PILEUPS
J. C. M. Li *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 147-150 refs (See N71-29926 17-26)
Avail: SOD $8.25

The usefulness of orthogonal polynomials and singular integral equations for the problem of dislocation pileups are described. A simple method of solving a few special integral equations is suggested. The usefulness of a Moutier cycle for the calculation of stress concentration is shown. Author

N71-29938# Manchester Univ. (England). Dept. of Metallurgy.
THE BEHAVIOR OF AN ELASTIC SOLID CONTAINING DISTRIBUTIONS OF FREE AND FIXED DISLOCATIONS
E. Smith *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 151-162 refs (See N71-29926 17-26)
Avail: SOD $8.25

A general expression is derived for relating stresses when fixed edge dislocations are contained within an infinite elastic solid in which there are also free edge dislocations that occupy equilibrium positions. Special cases are considered with particular attention being given to the situation where all the dislocations are of the same type, the free ones having identical Burgers vectors b while there are two fixed dislocations with Burgers vectors pb and qb; all the dislocations lie in the same plane within an infinite solid. The results are briefly discussed in relation to the problem of cleavage crack nucleation in crystalline solids. Author

N71-29939# Surrey Univ., London (England). Dept. of Physics.
THE ELASTIC INTERACTION BETWEEN GRAIN BOUNDARIES AND SCREW DISLOCATION PILEUPS
M. O. Tucker *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 163-171 refs Sponsored by Min. of Technol. (See N71-29926 17-26)
Avail: SOD $8.25

The configuration of an array of parallel infinitive straight screw dislocations, in equilibrium under a constant applied stress, and piled-up on a plane inclined to a grain boundary at an arbitrary angle is considered. The model used for the grain boundary is the plane interface between two elastically anisotropic half-spaces welded together. Using this approximation of a continuous distribution of infintesimal dislocations, the integral equation expressing the equilibrium conditions is solved using a Wiener-Hopf technique. Approximate expressions are presented for the stresses near to the tip of the array when the dislocations are parallel to orthotropic symmetry axes in each half-crystal. Author

N71-29940# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.

ONE ELECTRON THEORIES OF COHESION ON ION PAIR POTENTIALS IN METALS

N. W. Ashcroft *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 179-203 refs Sponsored in part by ARPA (See N71-29926 17-26)
(MSC-1147) Avail: SOD $8.25

The single particle picture of cohesion is briefly reviewed. The total energies in simple and transition metals are expressed as functions of ionic rather than electron densities or separations. Cohesion and ion-ion potentials of simple metals are also discussed. J.A.M.

N71-29941# California Univ., Irvine. Dept. of Physics.

LOCALIZED VIBRATION MODES ASSOCIATED WITH SCREW DISLOCATIONS

A. A. Maradudin *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 205-217 refs (See N71-29926 17-26)
(Grant AF-AFOSR-1448-68)
(TR-69-11) Avail: SOD $8.25

The dispersion relation for the one-dimensional continuum of localized modes associated with a screw dislocation is obtained in the long wavelength limit, as a function of the wave vector parallel to the dislocation line. The frequencies of localized vibration modes are determined. Author

N71-29942# Nebraska Univ., Lincoln. Behlen Lab. of Physics.

THE METHOD OF LATTICE STATICS

J. W. Flocken and J. R. Hardy *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 210-252 refs Sponsored in part by AEC (See N71-29926 17-26)
Avail: SOD $8.25

The formalism of the method of lattice statics for treating the lattice distortions and the formation and interaction energies associated with a defect in a crystal is presented. This approach is based on the Fourier transformation of the set of direct space equilibrium equations to reciprocal space. A similar approach is used to obtain Fourier transformed expressions for the relaxation and interaction energies associated with the defect. The solution of lattice statics for the Fourier amplitudes in the limit of small wave vectors gives expressions for the displacement field identical to those obtained from the theory of continuum elasticity. Author

N71-29943# Tokyo Univ. (Japan). Dept. of Physics.

EFFECT OF ZERO POINT MOTION ON PEIERLS STRESS

H. Suzuki *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 253-272 refs (See N71-29926 17-26)
Avail: SOD $8.25

Calculations of the Peierls stress hitherto made are criticized. The following conclusions are obtained: (1) The significant difference in Peierls stress between different materials arises mainly from the difference in crystal structures. (2) The Peierls stress is necessarily high in a rectangular lattice where atoms just above and below the slip plane face each other, while in the lattices where the atoms face alternately along the slip plane it is of the order of one percent of that in the rectangular lattice. (3) The Peierls stress in the body-centered cubic crystal is high for a screw dislocation owing to the screw structure of this crystal with the axes parallel to (111) direction. (4) The calculated Peierls stresses are several times of those expected from experiments. Author

N71-29944# Union Carbide European Research Associates, Brussels (Belgium).

POINT DEFECTS AND DISLOCATIONS IN COPPER

A. Englert, H. Tompa, and R. Bullough (United Kingdom Atomic Energy Authority, Harwell, Engl.) *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 273-283 refs (See N71-29926 17-26)
Avail: SOD $8.25

A new pair potential for copper was constructed from a set of ten interpolated cubic polynomials. The form of the potential is such that at short range it agrees with the usual Born-Mayer repulsive potential and is in satisfactory agreement with the available phonon dispersion data and the observed stacking fault energy and vacancy formation energy for copper. The potential was used to study the atomic configuration associated with various point and line defects in copper. Author

N71-29945# Argonne National Lab., Ill.

ATOMISTIC CALCULATIONS OF DISLOCATIONS IN SOLID KRYPTON

M. Doyama and R. M. J. Cotterill *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 285-289 refs (See N71-29926 17-26)
Avail: SOD $8.25

Atomic calculations of edge and screw dislocations in solid krypton were carried out using a pairwise potential. In rare gases, the electron redistribution of the electron density is small. Author

N71-29946# Technische Hochschule Aachen (West Germany). Inst. fuer Theoretische Physik C.

A LATTICE THEORY MODEL FOR PEIERLS ENERGY CALCULATIONS

A. Hoelzler and R. Siems *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 291-298 refs (See N71-29926 17-26)
Avail: SOD $8.25

A lattice theory model for a screw dislocation is discussed. For the forces between neighboring rows of atoms, a sinusoidal, not a linear, dependence of their relative displacements is assumed throughout the whole lattice. The displacements are expanded about the elastic theory values. The conditions of equilibrium yield a system of linear equations for the deviations of the displacements from the elastic theory values, which are solved by an iteration procedure making use of Green's function for a plane square lattice. For a number of points in the vicinity of the source point and for points in certain symmetry directions, a simple exact analytical expressions for the latter are derived; for points at larger distances an asymptotic expansion is given. The displacements are used to calculate the energies of the dislocation at the position of minimum energy and at the saddle point and their difference, the Peierls energy, by direct summation of the interaction energies of neighboring pairs of atoms. Author

N71-29947# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.

THE INTERACTION BETWEEN A SCREW DISLOCATION AND CARBON IN BODY CENTERED CUBIC IRON ACCORDING TO AN ATOMIC MODEL

R. Chang *In* NBS Fundamental Aspects of Dislocation Theory,

Vol. 1 Dec. 1970 p 299-303 refs (See N71-29926 17-26)
Avail: SOD $8.25

The interaction energy between carbon and a screw dislocation in body-centered cubic iron near the core regions of the dislocation was calculated atomistically using a pair-wise interatomic potential matching the elastic properties. It was assumed that the iron-carbon octahedron of the Johnson configuration remains undistorted whether it is present in a perfect or a defective lattice. Calculations yielded, depending on site location, binding energies varying from 0.04 to 0.55 eV. Author

N71-29948# Battelle Memorial Inst., Columbus, Ohio. Metal Science Group.
THE STRUCTURE OF THE /111/ SCREW DISLOCATION IN IRON
P. C. Gehlen, G. T. Hahn, and A. R. Rosenfield *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. Sponsored by ONR (See N71-29926 17-26)
Avail: SOD $8.25

The concept of a dissociated a/2 (111) screw dislocation was invoked to explain the slip behavior in bcc materials and particularly the asymmetry of the critically resolved shear stress. Using isotropic elasticity for alpha-iron, it was found that the dislocation core has three very narrow intrinsic faults. The calculations were repeated for anisotropic and isotropic elastic boundary conditions and with different interatomic potentials. Excellent agreement was found with Chang's configuration even though a volume expansion term was added to the displacements associated with the dislocation. It was shown that the final configuration is strongly dependent on the position of the dislocation line with respect to the lattice. Author

N71-29949# Tokyo Univ. (Japan). Dept. of Physics.
EIGENFREQUENCIES IN A DISLOCATED CRYSTAL
T. Ninomiya *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 315-361 refs (See N71-29926 17-26)
Avail: SOD $8.25

Dynamic theories of dislocation vibration and interactions with phonons are surveyed. Eigenfrequencies of lattice vibrations in a crystal containing a straight dislocation are calculated by using Lagrangian formalism. It is found that there is one eigenfrequency of dislocation vibration (wave number kappa in each of the intervals of the normal mode frequencies of k sub z - kappa in a perfect lattice. It is also found that there is a band of localized dislocation vibration below the phonon band. The mean squared amplitude of the dislocation vibration is determined by the localized mode for an edge dislocation and by the resonance modes for a screw dislocation. Author

N71-29950# Boeing Scientific Research Labs., Seattle, Wash.
PHONON SCATTERING BY DISLOCATIONS AND ITS INFLUENCE ON THE LATTICE THERMAL CONDUCTIVITY AND ON THE DISLOCATION MOBILITY AT LOW TEMPERATURES
P. P. Gruner *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 363-389 refs (See N71-29926 17-26)
Avail: SOD $8.25

The phonon-dislocation interaction is treated with nonlinear continuum theory. Terms up to the third order in the strains are retained in the Taylor expansion of the elastic energy density. These third order terms contain the phonon-dislocation interaction and the normal three-phonon interactions. In the case of thermal conductivity, the transport problem is solved with the variational method which leads to a system of linear equations for the phonon occupation numbers. The influence on the thermal conductivity of special dislocation configurations such as piled-up dislocations and dislocation dipoles is discussed. Author

N71-29951# Connecticut Univ., Storrs. Dept. of Physics.
PHONON SCATTERING BY COTTRELL ATMOSPHERES
P. G. Klemens *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 391-398 refs (See N71-29926 17-26)
(Grant AF-AFOSR-1517-68)
Avail: SOD $8.25

Cottrell atmosphere formation was used to change the scattering of phonons by dislocations and in some cases substantially enhance the lattice thermal resistivity due to dislocations. The strength of the atmospheres was also changed by annealing. The diffusion coefficient was determined by means of annealing studies. Author

N71-29952# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany).
DRAGGING FORCES ON MOVING DEFECTS BY STRAIN FIELD PHONON SCATTERING
A. Seeger and H. Engelke *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 397-401 refs (See N71-29926 17-26)
Avail: SOD $8.25

An expression for the dragging force on a uniformly moving defect by scattering of phonons at its strain-field was derived using nonlinear elasticity theory. Numerical calculations were performed for kinks in screw dislocations in copper. A comparison with numerical results was obtained in the theory of heat conductivity. Author

N71-29953# Brown Univ., Providence, R.I. Div. of Engineering.
THERMAL ENERGY TRAPPING BY MOVING DISLOCATIONS
J. H. Weiner *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 403-414 refs (See N71-29926 17-26)
(Grants AF-AFOSR-0228-67; AF-AFOSR-1738-69)
Avail: SOD $8.25

The steady motion of a dislocation along a piece-wise harmonic Frenkel-Kontorowa model is considered. For suitable model parameters one localized mode is associated with either the stable or unstable dislocation configuration and the remaining modes are nonlocalized or extended. Because of the piece-wise harmonic character of the model, the set of normal modes of the system is changed at discrete instants of time, referred to as transition times, as the dislocation moves along the chain. The particle momentum and energy due to the sum of the extended modes is termed thermal. Author

N71-29954# Illinois Univ., Urbana. Dept. of Physics.
DISLOCATION RESONANCE
J. A. Garber and A. V. Granato *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 419-421 refs (See N71-29926 17-26)
Avail: SOD $8.25

At low temperatures in insulators and superconductors, only reradiation of elastic waves should limit dislocation resonance. This effect was calculated using Eshelby's expression for the reradiation. It is found that the resonance is very sharp, and still persists even when a random distribution of dislocation segment lengths is assumed. Author

N71-29955# Illinois Univ., Urbana. Dept. of Physics.
DISLOCATION RADIATION
R. O. Schwenker and A. V. Granato *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 423-426 ref (See N71-29926 17-26)
Avail: SOD $8.25

Thin walls of mobile dislocations were produced. These can be excited to emit macroscopic plane sound waves. Calculations were made to predict the properties of the reradiated waves on the basis of a vibrating string model which neglects dislocation interactions. Author

N71-29956# Brown Univ., Providence, R.I. Dept. of Physics.
THE ANHARMONIC PROPERTIES OF VIBRATING DISLOCATIONS
C. Elbaum and A. Hikata *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 427–445 refs Sponsored in part by NSF (See N71-29926 17-26)
Avail: SOD $8.25

The anharmonic properties of vibrating dislocations are discussed in terms of the nonlinear stress-strain relation and of the higher harmonics of an ultrasonic wave generated when an initially sinusoidal wave propagates in a solid containing (mobile) dislocations. The harmonic amplitude was estimated and indicated that the lattice and dislocation components are comparable for the second harmonic and that the dislocation component is much larger than the lattice component for the third harmonic. Author

N71-29957# Columbia Univ., New York. Dept. of Engineering and Applied Science.
A SOURCE OF DISSIPATION THAT PRODUCES AN INTERNAL FRICTION INDEPENDENT OF THE FREQUENCY
W. P. Mason *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 447–458 refs (See N71-29926 17-26)
Avail: SOD $8.25

It was shown that internal friction is associated with dislocation motion. Using a model for which dislocation motion results from the motion of kinks, it is shown that such a loss can be associated with the energy dissipated when kinks cross Peierls barriers. Theoretical calculations show that the energy dissipated in mechanical vibrations requires a dissipative force equal to from 0.01 to 0.1 of the Peierls stress to replace the energy lost. Author

N71-29958# Battelle Memorial Inst., Geneva (Switzerland). Advanced Studies Center.
THE MEANING OF DISLOCATIONS IN CRYSTALLINE INTERFACES
W. Bollmann *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 465–477 refs (See N71-29926 17-26)
Avail: SOD $8.25

The extension of the dislocation concept to arbitrary crystalline interfaces is discussed. It is shown that invariance and continuity of the Burgers vector can be conserved and that in high angle boundaries the function of the standard or primary dislocation is the delimitation of ranges of coordination between the two crystals. In certain relative orientations where the superposition of the two crystals forms a highly periodic pattern, a slight deviation from that optimum pattern is corrected by a network of secondary dislocations. There is complete balance between the Burgers vectors of primary as well as secondary dislocations. Author

N71-29959# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
STRUCTURAL AND ELASTIC PROPERTIES OF ZONAL TWIN DISLOCATIONS IN ANISOTROPIC CRYSTALS
M. H. Yoo and B. T. M. Loh *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 479–493 refs Sponsored by AEC (See N71-29926 17-26)
Avail: SOD $8.25

Zonal twin dislocations for compound twin systems is described based on the well established rational crystallographic elements. Geometric characteristics of zonal twin dislocations in double lattice structures are discussed. Equilibrium shapes of an incoherent twin boundary were analyzed by using the anisotropic elastic properties of edge dislocations. Short-ranged structural properties of zonal twin dislocations are discussed based on a Peierls-Nabarro model. It is found that the anisotropic parameter predicts the active mode of crystallographically nonequivalent conjugate twin systems. Author

N71-29960# National Bureau of Standards, Washington, D.C.
NONPLANAR DISSOCIATIONS OF DISLOCATIONS
S. Mendelson *In its* Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 495–529 refs (See N71-29926 17-26)
Avail: SOD $8.25

Nonplanar dissociations of dislocations are studied in hcp, fcc, bcc, diamond lattice, tetragonal and orthorhombic crystal structures. The geometric and energetic conditions are shown to be favorable for various dissociations in each crystal structure. A general equation is formulated for dissociations into partials which are glissile on various twin planes of a common zone. The Burgers vector of the twinning dislocations are expressed in terms of orthogonal unit vectors which lie in the plane of shear of the twin mode. Author

N71-29961# Maryland Univ., College Park. Dept. of Mechanical Engineering.
PROPAGATION OF GLIDE THROUGH INTERNAL BOUNDARIES
M. J. Marcinkowski *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 531–545 refs (See N71-29926 17-26)
Avail: SOD $8.25

It was shown that when an internal boundary such as a grain boundary is cut by a crystal glide dislocation, a disturbance is left at the boundary. This disturbance closely resembles that about a crystal dislocation with the exception that (1) there is no extra half plane associated with the dislocation and (2) the Burgers vector associated with this disturbance is a variable which depends on the nature of the internal boundary. These boundary dislocations were termed virtual dislocations. The nature of the virtual boundary dislocations was treated for the symmetrical tilt boundary. Both homogeneous and heterogeneous type glide across these boundaries were applied to grain boundary crack formation and propagation, grain boundary rotation, preferred orientation, etc. Author

N71-29962# State Univ. of New York, Stony Brook. Dept. of Materials Science.
KINKS, VACANCIES, AND SCREW DISLOCATIONS
Robb M. Thomson *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 563–578 refs (See N71-29926 17-26)
Avail: SOD $8.25

A vacancy on a nonsplit pure screw dislocation dissociated into a set of kinks. This dissociation is demonstrated geometrically for the NaCl lattice, showing that no geometrical constraints are violated by the dissociation. The kinks also splinter and spread the charge of the vacancy along the line. The effective vacancy association energy on the line is higher than was supposed hitherto, and is partly due to the delocalization of the charge singularity of the point defect and partly due to the delocalization of elastic singularity. Author

N71-29963# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering.
TOPOLOGICAL RESTRICTION ON THE DISTRIBUTION OF DEFECTS IN SURFACE CRYSTALS AND POSSIBLE BIOPHYSICAL APPLICATION
W. F. Harris *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 579–292 refs (See N71-29926 17-26)
(Grant AF-AFOSR-0219-67)
Avail: SOD $8.25

Dislocations and disclinations were observed in some surface crystals. The perfect surface crystal is described by a basis vector pair and the conventional crystal by a basis vector triplet; both are regarded as embedded in a three dimensional space. The various defects are classified as local or global, intrinsic or extrinsic. Surface crystals that for closed surfaces are considered, along with the biophysical consequences. Author

N71-29964# Witwatersrand Univ., Johannesburg (South Africa). Dept. of Physics.

DISCLINATIONS IN SURFACES

F. R. N. Nabarro *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 593–606 refs (See N71-29926 17-26)

Avail: SOD $8.25

The idea of a disclination was developed in three dimensions. The special case of a screw disclination is essentially two-dimensional. A surface which has at every point a pattern which defines a direction or a set of equivalent directions lying in the surface is considered. A closed circuit is studied in the surface, and record the total change in the orientation of the pattern when the circuit is traversed once. Author

N71-29965# Laboratoire de Physique des Solides, Orsay (France).

APPLICATION OF DISLOCATION THEORY TO LIQUID CRYSTALS

J. Friedel and M. Kleman *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 607–636 refs (See N71-29926 17-26)

Avail: SOD $8.25

A general theory of dislocations in a mesomorphic medium is outlined. On the basis of their symmetry properties, and of viscosity relaxation, it is shown that perfect disclinations in nematic crystals may take any shape and are restricted to straight lines in smectic crystals, and that both types exist in cholesteric crystals, where there are two possible axes of rotation. Cholesteric crystals are also studied for which a multiple disclination to take any shape, at the expense of a small increase of energy in the faulted ribbon. Author

N71-29966# Technische Hochschule Stuttgart (West Germany). Inst. fuer Theoretische und Angewandte Physik.

NONMETRIC CONNEXIONS, QUASIDISLOCATIONS AND QUASIDISCLINATIONS. A CONTRIBUTION TO THE THEORY OF NONMECHANICAL STRESSES IN CRYSTALS

K. H. Anthony *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 637–649 refs (See N71-29926 17-26)

Avail: SOD $8.25

Nonmechanical stresses produced by a temperature gradient or by an internal magnetic field are related to an affine lattice connexion, which is nonmetric with respect to the elastic metric. The covariant derivative of the elastic metric with respect to the lattice connexion is regarded as source-function for this kind of internal stresses. It was determined from experimental data. Author

N71-29967# National Bureau of Standards, Washington, D.C. Metallurgy Div.

LINEAR THEORY OF STATIC DISCLINATIONS

R. de Wit *In its* Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 651–673 refs (See N71-29926 17-26)

Avail: SOD $8.25

Compatible and incompatible elasticity theory is reviewed. It is shown how dislocation theory was developed from classical compatible elasticity. Disclination theory is developed from dislocation theory in an analogous way. The disclination and dislocation density tensors are defined from the plastic deformation; the total deformation satisfies the classical condition of compatibility. By combining these two concepts the geometric basic laws or field equations are found, which relate the elastic deformation to the defect content. The contortion or Nye curvature tensor is found to be a useful equivalent for the dislocation density. The dualism between the geometry of disclination theory and the statics of couple-stress theory, as well as the relation of disclination theory to motor calculus are pointed out. Author

N71-29968# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.

INTRODUCTION TO THE PANEL DISCUSSION INTRINSIC PROPERTIES OF DISLOCATIONS

J. P. Hirth *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 1 Dec. 1970 p 683–685 refs (See N71-29926 17-26)

Avail: SOD $8.25

The current status of the dislocation theory was assessed with emphasis on the intrinsic properties of the dislocations as opposed to those of other physical entities. A historical comment on the dislocation theory is briefly noted. Author

N71-29969# National Bureau of Standards, Washington, D.C.

FUNDAMENTAL ASPECTS OF DISLOCATION THEORY, VOLUME 2

John A. Simmons, R. de Wit and R. Bullough, eds. Dec. 1970 596 p refs Conf. held at Gaithersburg, Md. 21–25 Apr. 1969 (NBS-SP-317-Vol-2) Avail: SOD $8.25

Nonlinear field theories are developed for analyzing crystal dislocations. Considered are aspects of thermal activation, dislocation-electron interactions, and statistical modeling. For individual titles, see N71-29970 through N71-30003.

N71-29970# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Inst. fuer Theoretische Physik.

THE PROBLEM OF NON-LOCALITY IN THE MECHANICS OF SOLIDS: REVIEW ON PRESENT STATUS

E. Kroener *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 729–736 refs (See N71-29969 17-26)

Avail: SOD $8.25

The concept of non-locality, in particular with reference to the mechanics of solids, is discussed. A brief report is given on the derivation of the non-local theory of elasticity from atomic lattice theory. In addition some simple solutions of this theory, concerning the interaction of dilatation centers and wave propagation, are quoted. A generalization of the theory which would include dislocations is indicated. Author

N71-29971# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Inst. fuer Theoretische Physik.

NONLOCAL THEORY OF ELASTICITY FOR A FINITE INHOMOGENEOUS MEDIUM: A DERIVATION FROM LATTICE THEORY

E. Kroener and B. K. Datta *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 737–746 refs (See N71-29969 17-26)

Avail: SOD $8.25

In the linear theory of non-local elasticity the strain energy can be written as a double volume integral summing up the interactions of pairs of mass elements. The properties of the material, in this case, are described by a two point tensor function. It is found that for finite bodies the function does not have the symmetries of the (Hooke's) elasticity tensor of the local theory. However, the symmetries of this tensor function are sufficient to exclude the rotations from the strain energy expression. It is shown that with the help of the elastic Green's function one can express the two point tensor function in terms of force constants of the lattice. It is also shown that an infinite homogeneous body is not a suitable model either for the non-local or for the local theory, because in this case the two point tensor function as well as the elasticity tensor obey the Cauchy relations. Author

N71-29972# Akademiya Nauk SSSR, Novosibirsk.

ON PROBLEMS OF THE NONLOCAL THEORY OF ELASTICITY

I. A. Kunin and A. M. Waisman *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2, Dec. 1970 p 747–780 refs (See N71-29969 17-26)

Avail: SOD $8.25

New results concerning the linear theory of an elastic medium with non-local interactions are: (1) the structure of the general solution of the equations of motion and the dependence of the general solution on the distribution of energy operator zeroes. Specific effects of the non-locality are new types of damped and undamped waves, the existence of a maximum frequency for the latter ones, (2) approximate models for the long-wave approximations; the first zeroes approximations and the domains of their applicability; and (3) the replacing of the boundary by a boundary layer of width of the interaction radius, and fundamental boundary value problems and their comparison with coupled stress theories. Author

N71-29973# Tokyo Univ. (Japan).
A NON-RIEMANNIAN CONSTRUCTION OF VARIATIONAL CRITERIA FOR PLASTIC MANIFOLDS WITH SPECIAL REFERENCE TO THE THEORY OF YIELDING
Kazuo Kondo *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 461-484 refs (See N71-29969 17-26)
Avail: SOD $8.25

The variational formalism is viewed not as an independent assumption but as a natural consequence following from a more fundamental penetration into the recognition of nature and this is shown in regard to the static aspects of plasticity. The energy is defined as the necessary quantity for the geometrical construction. With the Riemannian and non-Riemannian picture, a bridge is sought between the theory of yielding and the theory of dislocations, as also between the theory of dual yielding and theory of coupled stresses. The theory of yielding and dual yielding is explained constitutively with a statistical construction to reconfirm the formulae which have been proposed. The meaning of the plastic constants involved in the theory is clarified by the construction. Author

N71-29974# Academia R. P. R., Bucharest. Center of Mechanics of Solids.
DERIVATION OF A CONTINUUM THEORY OF DISLOCATIONS ON THE BASIS OF AN ESTIMATIVE ANALYSIS OF CRYSTAL LATTICES
M. Misicu *In* NSB Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 785-816 refs (See N71-29969 17-26)
Avail: SOD $8.25

Starting from the non-primitive crystal lattice model, a continuum theory is derived by means of an interpolation procedure which takes into account the variability of kinematic and dynamic fields. The non-holonomy of the fields of displacements, energy and entropy is considered in order to elaborate the analysis of dislocation and irreversible effects. Author

N71-29975# Belgrade Univ. (Yugoslavia). Dept. of Mechanics.
THE ELASTIC GENERALIZED COSSERAT CONTINUUM WITH INCOMPATIBLE STRAINS
R. Stojanovic *In* NSB Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 817-830 refs (See N71-29969 17-26)
Avail: SOD $8.25

A continuum with deformable directors is considered. Dislocations are regarded as sources of incompatibilities and internal strains. Established are the relations between the dislocation density tensor and the gradients of directors. The conservation law for dislocations appears as the integrability condition for the dislocation density-gradients of directors relation. In a linearly connected space in which the directors of a dislocated medium represent fields of absolutely parallel vectors the equality of the dislocation density tensor with the torsion tensor of the space follows as an immediate consequence. Derived are the general (non-linear) relations for stress and hyperstress. The stress tensor is not symmetric. Author

N71-29976# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany).
A DYNAMIC THEORY OF DISLOCATIONS AND ITS APPLICATIONS TO THE THEORY OF THE ELASTIC-PLASTIC CONTINUUM
C. Teodosiv (Tech. Hochschule Stuttgart, West Germany) *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 837-876 refs (See N71-29969 17-26)
Avail: SOD $8.25

The formulation for the dynamic nonlinear theory of dislocations in anisotropic media is considered. To construct a theory of the elasto-plasticity, the system of kinematic equations is completed by postulating a yield condition and a work-hardening equation, which contain as independent variables the stress, the dislocation density, the density of dislocation loops, and the temperature. Making constitutive assumptions for the free energy, the specific entropy, and the heat conduction vector, and using the principle of material indifference and the thermodynamical restrictions, a definite theory of the elastic-plastic continuum is obtained. Author

N71-29977# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany).
NONLINEAR DYNAMIC PROBLEMS FOR ANISOTROPIC ELASTIC BODIES IN THE CONTINUUM THEORY OF DISLOCATIONS
C. Teodosiu and A. Seeger *In* NBS Fundamental aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 877-906 refs Prepared in cooperation with Tech. Hochschule Stuttgart, West Germany (See N71-29969 17-26)
Avail: SOD $8.25

Approximative methods for solving nonlinear problems such as the determination of the strains produced by stationary or uniformly moving dislocations in anisotropic media and of their effects on a superimposed infinitesimal motion are developed. The nonlinear problems are solved by reduction to a series of linear problem using expansions in terms of small parameters. Three such parameters appear naturally: the magnitude of the distortion produced by dislocations, the magnitude of the deformation gradient of the superimposed motion, and the ratio between the dislocation and sound velocities. To obtain definite approximation algorithms, hypotheses concerning the relative order of magnitude of these three parameters are introduced. Author

N71-29978*# Rice Univ., Houston, Tex. Dept. of Mathematical Sciences.
ON THE THERMODYNAMICS OF INHOMOGENEOUS BODIES
C. C. Wang *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 907-924 refs (See N71-29969 17-26)
(Grants NSG-6-59; NSF GP-9358)
(NASA-CR-119065) Avail: SOD $8.25; NTIS CSCL 20L

The thermodynamics of inhomogeneous elastic bodies are considered. The constitutive equations for thermoelastic materials are used to develop a theory for bodies made up of such materials. The general scheme of this theory is based on a concept of generalized simple bodies. The main results are the explicit field equations for the deformation and the temperatue on a thermoelastic body. Author

N71-29979# Florida Univ., Gainesville. Dept. of Engineering Science and Mechanics.
ELASTIC-PLASTIC PLANE BENDING OF A SINGLE CRYSTAL
C. S. Hartley and M. A. Eisenberg *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 925-942 refs Sponsored by ONR (See N71-29969 17-26)
Avail: SOD $8.25

The elastic-plastic bending of a single crystal beam which deforms by single slip on a plane containing the axis of bending and in a direction normal to the axis of bending is analyzed. Both continuum plasticity and dislocation approaches are used to obtain

stresses and/or displacements in the elastic and plastic regions. The relation between the applied bending moment and the curvature of the neutral axis is also obtained. The approaches are compared and correspondences between the two theories are discussed. Author

N71-29980# Instituto Technologico de Aeronautica, Sao Paulo (Brazil).
GENERALIZED STRESS AND NON RIEMANNIAN GEOMETRY
S. I. Ben-Abraham *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 943-962 refs (See N71-29969 17-26)
Avail: SOD $8.25

The general non-Riemannian approach to the geometry of a solid with lattice defects is briefly discussed. Non-Riemannian geometry is applied to the treatment of statics. The stress curvature tensor has the meaning of a generalized stress tensor with 27 components, while the associated Einstein tensor represents the classical stress tensor. The stress connexion expresses the generalized moment stress having 27 components. Its torsion tensor is the classical coupled stress tensor. The identities of the curvature tensors are identified with the static equilibrium conditions. Using a stress function density instead of a metric tensor, it is shown that the equilibrium conditions can always be identically fulfilled. A consistent theory involving lattice defects must necessarily involve also generalized moment stresses and generalized stresses. Author

N71-29981# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
THE ELASTIC FIELD OF MOVING DISLOCATIONS AND DISCLINATIONS
T. Mura *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 977-998 refs Sponsored by ARPA. (See N71-29969 17-26)
Avail: SOD $8.25

A study on the elastic field of moving dislocations and disclinations is reviewed. Emphasis is placed upon the general method and approach using Green's tensor functions and Fourier integrals. The previous solutions for individual problems are reviewed as examples of this unified approach. Author

N71-29982# Instituto Technologico de Aeronautica, Sao Paulo (Brazil).
KINEMATICS OF CONTINUOUSLY DISTRIBUTED DISLOCATIONS
S. I. Ben-Abraham *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 999-1020 refs (See N71-29969 17-26)
Avail: SOD $8.25

The general non-Reimannian approach to the geometry of a solid with lattice defects is extended to include the kinematics. The treatment is valid for both the motion of old defects and the creation of new ones. The change in a geometric quantity is described by a corresponding rate. The main quantities dealt with are distortion rates, stretching tensors and connexion rates, and new quantities called fluxions are introduced. In terms of these a fundamental kinematic law and continuity equations for the defect currents are set up and are found to be consistent with earlier results valid in special cases. Author

N71-29983# Princeton Univ., N.J.
A MICROMORPHIC APPROACH TO DISLOCATION THEORY AND ITS RELATION TO SEVERAL EXISTING THEORIES
A. C. Fringen and W. D. claus, Jr. (Textile Res. Inst.) *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1023-1040 refs Sponsored by ONR (See N71-29969 17-26)
Avail: SOD $8.25

Two separate continuum dislocation theories are presented; one dealing with static, incompatible, micropolar dislocations and disclination, as encountered in initial stress problems, and the other with a dynamical theory of micromorphic solids containing continuous distributions of dislocations. Relationships between several continuum dislocation theories and micromorphic mechanics are established by providing extensions and new interpretations of the micromorphic theory. The micromorphic kinematics are used to introduce dislocaton density, strain, and microstrain tensors and to construct constitutive equations. Together with the balance laws this constitutes a complete dynamical theory for predictions of motions and micromotions of a solid containing dislocations undergoing elastic deformations. From the micromotion, the dislocation density and first stress moments are calculated. Author

N71-29984# Sheffield Univ. (England). Dept. of Applied Mathematics.
ON THE CONTINUUM THEORY OF DISLOCATIONS
N. Fox *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1041-1052 refs (See N71-29969 17-26)
Avail: SOD $8.25

The kinematics of an oriented medium is discussed with reference to the continuum theory of dislocations. The concepts of dislocation density, dislocation flux and slip velocity are introduced and a corresponding constitutive theory is developed. Author

N71-29985# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany). Inst. fuer Physik.
DISLOCATION DYNAMICS IN THE PRESENCE OF A MULTIPLE SPECTRUM OF THERMALLY SURMOUNTABLE BARRIERS
W. Frank *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1065-1076 refs (See N71-29969 17-26)
Avail: SOD $8.25

A theoretical treatment is given of the thermally activated motion of dislocations in the presence of dislocation barriers with different heights. The height of a barrier is allowed to depend on an arbitrary number of characteristic parameters (multiple obstacle spectrum). Under the assumptions which are usually made for the derivation of an Arrhenius equation for the slip rate in the case of a uniform array of dislocation barriers, a is calculated for a multiple spectrum of barriers. It is found that even under these conditions the validity of an Arrhenius equation is preserved. An application of the spectrum theory is discussed. Author

N71-29986# Argonne National Lab., Ill. Materials Science Div.
FLOW AND THE ARRHENIUS EQUATION IN THE STATISTICAL FRAMEWORK
U. F. Kocks *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1077-1082 refs Sponsored by AEC (See N71-29969 17-26)
Avail: SOD $8.25

The rate equation of plastic flow and a general work-hardening law are combined into a single equation of flow. It degenerates into the Arrhenius law only under certain specified conditions. A single Arrhenius term with temperature insensivie pre-exponential (and entropy) terms adequately describes the rate dependence of dislocation motion through a slip plane studded with obstacles of any spectrum of strengths and spacings. In this case, the mobile dislocation density in the slip plane generally does not enter the flow equation; only the density of slip planes does. Author

N71-29987# Oxford Univ. (England).
MOVEMENT OF A DISLOCATION THROUGH RANDOM ARRAYS OF POINT AND PARALLEL LINE OBSTACLES
A. J. E. Foreman (U. K. Atomic Energy Establishment, Harwell,

England), P. B. Hirsch, and F. J. Humphreys *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1083–1098 refs (See N71-29969 17-26)
Avail: SOD $8.25

The motion of a dislocation through random arrays of impenetrable point and parallel line obstacles is considered. For impenetrable point obstacles the difference in line tension for edges and screws, and the elliptical equilibrium shape of the bowing-out loop are taken into account, and the yield stress for screws and edges is found to be the same. The results of a calculation of the effect of interaction between neighboring segments of the dislocation on the critical breaking angle and on the yield stress are presented. Computer calculations on the motion of dislocations through random arrays of parallel line obstacles show that the dislocations move by the generation and motion of large kinks. The yield stress is found to increase approximately linearly with the obstacle length. These calculations are relevant to and are compared with the hardening in the early stages of the work hardening curve of dispersion hardened alloys containing small particles. Author

N71-29988# Illinois Univ., Urbana. Dept. of Physics.
STRAIN RATES IN DISLOCATION DYNAMICS
W. de Rosset and A. V. Granato *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1099–1106 refs (See N71-29969 17-26)
Avail: SOD $8.25

The relating of yield phenomena in LiF to direct measurements of dislocation velocities and densities by the lambda b nu expression for the strain rate has been used almost exclusively, where Lambda is the mobile dislocation density, b the Burgers vector, and nu is the average dislocation velocity. The strain rate is independent of dislocation velocity when the velocity is large enough and the strain rate is given in a simplified model by Lambda b chi where chi is the average distance traveled by a dislocation. The strain rate is eventually determined, then, by the rate at which new dislocations are created and not necessarily by the rate at which old dislocations expand or by the dislocation velocity. Author

N71-29989# Oxford Univ. (England). Dept. of Metallurgy.
ON THE MECHANISM OF CROSS-SLIP OF DISLOCATIONS AT PARTICLES
M. S. Duesbery and P. B. Hirsch *In* Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1115–1134 refs (See N71-29969 17-26)
Avail: SOD $8.25

The effect of the misfit strain field upon the mechanism of cross-slip of dislocations at impenetrable particles in two phase alloys is considered. The strain field is found to have a profound effect on the activation energy for cross-slip. Author

N71-29990# Technische Hochschule Stuttgart (West Germany). Inst. fuer Theoretische und Angewandte Physik.
THEORIES OF THERMALLY ACTIVATED PROCESSES AND THEIR APPLICATION TO DISLOCATION MOTIONS IN CRYSTALS
H. Engelke *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1137–1156 refs (See N71-29969 17-26)
Avail: SOD $8.25

The plastic behavior of crystals is to a considerable extent determined by thermally activated processes involving dislocations. These processes are mostly treated by applying the theory of absolute reaction rates and the string approximation of dislocation. The limits of validity of these treatments are discussed with a view of more recent developments both in the theory of thermally activated processes and in dislocation dynamics. As an example for the application of the Kramers–Brinkman diffusion theory of chemical reactions to dislocation problems a treatment of double kink relaxation (Bordoni relaxation) is reviewed. Author

N71-29991# Battelle Memorial Inst., Columbus, Ohio.
SLIGHTLY DISSOCIATED DISLOCATIONS
R. Hobart *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1157–1161 refs Sponsored by AFOSR (See N71-29969 17-26)
Avail: SOD $8.25

A modified Peierls–Nabarro model is used to calculate the relation between the separation of partials and stacking fault energy for an idealized dislocation dissociated into two equal pure screw partials. The resulting expression agrees with the inverse dependence obtained by equating the elastic repulsion of the partials to the attraction of the stacking fault, but unlike that result does not break down at zero separation. Also an argument is given that the width of such a dissociated dislocation should be considered as a complex quantity, with the imaginary part corresponding to the separation of the partials. Author

N71-29992# Illinois Univ., Urbana. United Kingdom Atomic Energy Authority, Harwell (England).
THE BROADENING OF RESONANCE LINES BY DISLOCATIONS
A. M. Stoneham *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1169 1173 refs Prepared in cooperation with United Kingdom Atomic Energy Authority (See N71-29969 17-26)
Avail: SOD $8.25

Dislocations and other defects broaden sharp resonance lines in solids, such as spin resonance and optical zero phonon lines. The broadening is a result of the random strain fields produced, and the shape of the resonance line is a measure of the distribution of internal strains. Measurement of line shapes can give information which is different from that given by the more usual mechanical and transport studies of dislocations. Calculated are the shapes of the resonance lines in terms of the properties of the individual defects which cause broadening, their density and their statistical distribution. The theory is applied to straight dislocations, infinitesimal loops, dislocation dipoles and to point defects. Author

N71-29993# Argonne National Lab., Ill. Metallurgy Div.
DISLOCATION PAIR INTERACTION IN A FINITE BODY
R. O. Scattergood and V. F. Kocks *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1179–1190 refs Sponsored by AEC (See N71-29969 17-26)
Avail: SOD $8.25

The elastic interaction between dislocations in a finite body shows important features not found in an infinite body. For example, two like dislocations parallel to the axis of a cylinder repel each other only when they are close, but attract each other when their distance is comparable to the cylinder radius. Contours of the pair interaction energy are given for both screw and edge dislocations in a circular cylinder. These new features appear not only when free surface conditions are demanded on the entire body, but even when approximate stress fields are used that demand some surface tractions, so long as no torques are transmitted through the body. The relevant torques (bending moments) associated with an edge dislocation in a circular cylinder, which vanish when the mantle is traction free, may be made to vanish in general by a simple modification of the stress field of the edge dislocation. Author

N71-29994# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany). Inst. fuer Physik.
THE MEAN SQUARE STRESSES (SIGMA SQUARED) FOR A COMPLETELY RANDOM AND A RESTRICTEDLY RANDOM DISTRIBUTION OF DISLOCATIONS IN A CYLINDRICAL BODY
M. Wilkens *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1191–1194 refs (See N71-29969 17-26)

Avail: SOD $8.25

A full proof is given according to which the elastic interaction energy of completely randomly distributed dislocations vanishes. As a consequence the outer cut-off radius in the logarithmic factor of the elastic energy coincides with the external cylinder radius rather than with the mean dislocation spacing. The proof takes into account the elastomechanical boundary conditions which were neglected in the earlier paper. Further it is shown that for a restrictedly random distribution the outer cut-off radius is equivalent to the radius of the areas small compared with the cylinder cross-section, each of which contains the same number of dislocations randomly distributed over the corresponding area. In the special case that each area contains only one dislocation with arbitrary inside the area the outer cut-off radius degenerates to the mean dislocation spacing. Author

N71-29995# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany). Inst. fuer Physik.

THEORETICAL ASPECTS OF KINEMATICAL X-RAY DIFFRACTION PROFILES FROM CRYSTALS CONTAINING DISLOCATION DISTRIBUTIONS

M. Wilkens *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1195–1222 refs (See N71-29969 17-26)

Avail: SOD $8.25

The paper deals with a theoretical study of the Fourier transform of the X-ray diffraction line profiles from crystals containing dislocation distributions. The theory is based mainly on a calculation of spatial averages of powers of the strains. The second power average is calculated in a closed form for a restrictedly random dislocation distribution. However, the result is approximately valid also for other distributions. The contributions of the averages of higher powers are taken into account in an approximate manner. The expression derived for the Fourier transform depends on the two parameters rho and R sub e, where rho is the dislocation density. R sub e is equivalent to the effective outer cut-off radius which appears for instance in the logarithmic factor of the elastically stored energy. Author

N71-29996# Illinois Univ., Urbana. Dept. of Physics.

THERMODYNAMIC PROPERTIES OF SOLIDS CONTAINING DISLOCATIONS

J. Holder and A. V. Granato *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1223–1225 refs (See N71-29969 17-26)

(Contract AT(11-1)-1198)

Avail: SOD $8.25

Using thermodynamics and elasticity theory, a unified treatment of the changes in the thermodynamic properties of solids containing dislocations is given. The results are expressed in terms of temperature and pressure derivatives of the formation energy of the dislocations. The required pressure and temperature dependence of the energy is given by the measured pressure and temperature dependence of the elastic constants appearing in the energy expression found at zero pressure and temperature. The method is not restricted to calculations of volume changes, or to isotropic, static or even elastic systems at zero pressure. Changes in entropy, specific heat, thermal expansion and bulk modulus due to dislocations are easily calculated. Author

N71-29997# Universitaets-Sternwarte Goettingen (West Germany). Inst. fuer Metallphysik.

CHARGED DISLOCATIONS IN THE DIAMOND STRUCTURE

P. Hassen and W. Schroeter *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1231–1253 refs Sponsored by Deutsche Forschungsgemeinschaft (See N71-29997 17-26)

Avail: SOD $8.25

The electronic states at dislocations in elemental semiconductors are reviewed in the light of new experimental and theoretical work. Evidence is produced for the existence of a one dimensional energy band along edge as well as screw dislocations. This explains quantitatively their ability to act as donors as well as acceptors depending on temperature, doping, and dislocation density. The degree of charging has been recalculated from the free energy of a system of charged dislocations screened by free carriers. The dislocation charge limits the Hall mobility in addition to the strain field of the dislocation. Measurements of photoconductivity of deformed semiconductors support the above model of the charged dislocation. The dislocation charge influences the Peierls force and thus the mobility of dislocations in the diamond structure. The occupation limit of the neutral dislocation, measured from the valence band edge, lies at 0.09 eV in germanium, and at 0.3 eV in silicon. Author

N71-29998# Paris Univ., Orsay (France).

ELECTRONIC EFFECTS ASSOCIATED WITH STACKING FAULTS IN NORMAL METALS

C. Nourtier and G. Saada *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1259–1278 refs (See N71-29969 17-26)

Avail: SOD $8.25

A simple pair interaction model is used to make the following calculations: (1) stacking fault energy of simple metals; (2) interaction energy between a stacking fault and an impurity atom or a vacancy, and application to the study of segregation effects; and (3) interaction energy of parallel stacking faults. Numerical results are given and consequences of the long range interaction between defects are discussed. Author

N71-29999# State Univ. of New York, Stony Brook. Dept. of Materials Science.

THEORY OF SURFACE STATES ON STACKING FAULTS

Robb M. Thomson *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1279–1288 refs (See N71-29969 17-26)

Avail: SOD $8.25

The Slater–Koster method in the Bloch representation is applied to a model for a stacking fault in an idealized crystal leading to a type of Shockley surface state. A series expansion is obtained for the energy which is worked out for the simplified case of a constant matrix element, with the result that for a tight binding nonoverlapping band, there are surface waves which split off from both the top and bottom of the band. Contrary to Shockley's results for external surfaces, and to the Slater–Koster theory of the localized impurity, localized states occur on the stacking fault for a single nonoverlapping band and for arbitrary potential values. A constant matrix approximation is worked out for the case of the simple metals. Author

N71-30000# Brown Univ., Providence, R.I. Dept. of Physics.

INTERACTIONS OF DISLOCATIONS WITH ELECTRONS IN METALS

C. Elbaum and A. Hikata *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1291–1292 refs Sponsored in part by NSF (see N71-29969 17-26)

Avail: SOD $8.25

Physical arguments are given to show that the interaction of moving (vibrating) dislocations with conduction electrons in metals is independent of temperature. Calculations based on the assumption that the Fourier components of the displacement field of a moving dislocation can be treated as pseudo-phonons give the same result. These conclusions are confirmed by the results of recent experiments. Author

N71-30001# Brown Univ., Providence, R.I. Dept. of Physics.

ELECTRONIC ENERGY STATES OF DISLOCATIONS: THE CASE OF COVALENT-IONIC SOLIDS

C. Elbaum and R. R. Holmes *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1293-1302 refs (See N71-29969 17-26)
(Contract Nonr-562(27))
Avail: SOD $8.25

It is shown that electronic energy bands are associated with dislocations in wideband-gap, compound semiconductors. The eigenvalue problem for the dislocation band edge is solved for CdS-type crystals, and the occupation of the band is calculated. The Fermi energy is then determined for crystals containing many deep lying discrete levels as well as dislocation bands. It is predicted that when a crystal is illuminated with light of appropriate wavelength and increasing intensity, the thermal activation energy governing the electrical conductivity passes through a series of energy plateaus which are equal to the energy of the discrete levels. In a dislocation free crystal, these plateaus are connected by step changes, while in a crystal with dislocations they are connected by broad transition regions. The above predictions have been verified experimentally. Author

N71-30002# United States Steel Corp., Monroeville, Pa.
INTERACTIONS BETWEEN ELECTRONS AND MOVING DISLOCATIONS
G. P. Huffman and N. Louat *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1303-1322 refs (See N71-29969 17-26)
Avail: SOD $8.25

A moving dislocation in a metal induces an electric field which causes currents in the conduction electron gas. The energy dissipation associated with these fields and currents is calculated from the Boltzmann equation in a manner analogous to theories of acoustical attenuation. It is found that the applied stress required for steady motion is proportional to the dislocation velocity divided by the electrical resistivity. In good agreement with low temperature yield and flow stress measurements on bcc metals. The concept of a large electronic component of drag which increases with decreasing temperature is used to give a qualitative explanation of the observed mechanical properties of bcc metals. Author

N71-30003# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany).
REPORT ON THE PANEL DISCUSSION: FUTURE DIRECTIONS FOR DISLOCATION THEORY
A. Seeger (Tech. Hochschule Stuttgart West Germany) *In* NBS Fundamental Aspects of Dislocation Theory, Vol. 2 Dec. 1970 p 1329-1336 (See N71-29969 17-26)
Avail: SOD $8.25

The difficult task of predicting further developments in the field of dislocation theory is considered. The main problem is the development of new methods and techniques for doing practical and reliable calculations rather than discovering new fundamental ideas. Possible numerical calculations on nonlinear problems involving dislocations in anisotropic media, the development of dislocation dynamics proper, and the theory of the interactions between dislocations and other fields in crystals play an important role in the near future. Another problem is the construction of a macroscopic theory of plasticity based on dislocation theory. Author

N71-30021 Utah Univ., Salt Lake City.
STUDIES ON RECRYSTALLIZATION IN DILUTE ALLOYS OF MAGNESIUM
William Jong-Jau Hong (Ph.D. Thesis) 1970 95 p
Avail: Univ. Microfilms Order No. 70-14447

Experimental work was carried out to determine the recrystallization kinetics of magnesium-cadmium and magnesium-zirconium dilute alloys using an X-ray diffraction technique. A theory was developed to explain the linear variation of per cent recrystallization with log time as observed in these alloys. Free energies of activation for recrystallization in Mg-Cd and Mg-Zr were sound to be 42 and 30 kilocalories per mole respectively. Pole figures were determined for Mg, Mg-Cd and Mg-Zr alloys in the cold worked and annealed conditions. Inverse pole figures were determined for pure Mg in the cold worked and annealed state. Variations were measured in the a and c lattice parameters of Mg as a function of the amount of Zn, Cd, Zr, and Ni added. Possible causes for the observed effects of impurity additions were discussed. Those elements which have a limited solubility in Mg and a distribution coefficient less than one such as Zn, Cd, Ni have the greatest effect in increasing the recrystallization temperature. Dissert. Abstr.

N71-30031# Northeastern Univ., Boston, Mass. Dept. of Physics.
REMARKS ON A GENERAL LATTICE STATISTICAL MODEL
F. Y. Wu May 1971 5 p refs
(Grant NSF GP-25306)
(NUB-2077) Avail: NTIS

The sixteen-vertex lattice statistical model is shown to be equivalent to an eight-vertex problem. Arguments are given that this model possesses continuously variable critical exponents alpha and alpha'. Author

N71-30032# Northeastern Univ., Boston. Dept. of Physics.
ISING MODEL WITH FOUR SPIN INTERACTIONS
F. Y. Wu Apr. 1971 9 p refs
(Grant NSF GP-25306)
(NUB-2068) Avail: NTIS

It is shown that Baxter's recent results on a lattice statistical model lead to the solution of an Ising model with two- and four-spin interactions. Critical properties of this Ising model in various regions of the parameter space are given. It is argued that four-spin or crossing interactions in a two-dimensional Ising model would in general lead to a critical exponent alpha' does not = 0. Author

N71-30065 George Washington Univ., Washington, D.C.
THERMOLUMINESCENCE-METAMICTIZATION RELATIONS IN ZIRCON
Jesus Eduardo Vaz (Ph.D. Thesis) 1969 70 p
Avail: Univ. Microfilms Order No. 70-14368

A study has been made on the effects of natural radiation damage on thermoluminescence (TL) artificially induced by gamma radiation in gem-quality zircons. This was done by analyzing the TL response to gamma ray irradiation of polished pieces of the gemstones with a range of radioactive impurity content (0.004 % to 0.6 % equivalent uranium), before and after heating of the samples at 950 C for 20 hours in a nitrogen atmosphere. Natural radiation damage is shown to reduce the TL output of the material by a factor of 100,000. Thermal annealing of the samples causes an enhancement of the light output. The enhancement is alpha dose dependent, being greatest in the samples with relatively low total alpha doses. Age determinations were carried out on nine highly metamict zircon concentrates from different localities using the TL-alpha dose relation established from the Ceylon zircons. Dissert. Abstr.

N71-30068 Brown Univ., Providence, R.I.
ELECTRIC FIELD INDUCED MOTION OF DISLOCATION ARRAYS IN IONIC CRYSTALS
Lewis Thomas Lipton (Ph.D. Thesis) 1969 106 p
Avail: Univ. Microfilms Order No. 70-8753

The electric charge associated with lattice discontinuities in ionic crystals was studied. This charge comes about because of the difference in free energy of formation of positive and negative ion vacancies in these crystals, which causes unequal numbers of vacancies of each type. Since vacancies in an ionic crystal have an effective electric charge, an excess of one type of vacancy will lead to a net electric charge on any lattice discontinuity which can

serve as a source or sink of vacancies. The displacement of an array of dislocations (a low-angle grain boundary) were observed in a crystal which was placed in an external electric field. A model was proposed to explain the migration of a dislocation array based on the climb of dislocations in a vacancy concentration gradient caused by the action of the external electric field at the site of the array. The model predicts a velocity dependent exponentially on reciprocal temperature. The concentration of positive divalent impurity at the boundary was also determined in this experiment. Dissert. Abstr.

N71-30102# California Univ., Livermore. Lawrence Radiation Lab.
PRINCIPLES OF OPERATION OF SEMICONDUCTOR DETECTORS
Guy A. Armantrout 10 Feb. 1971 50 p Presented at the Symp. on the Role of Semicond. Detectors in the Future of Nucl. Med., Chicago, Ill., 12–13 Feb. 1971 Sponsored by AEC
(UCRL-73001; Conf-710204-2) Avail: NTIS

Topics include structure of an atom, effects of radiation on an atom, radiation detection using a gas, solids as radiation detection media, optimization considerations for a p-n junction detector, and practical p-n junction devices. NSA

N71-30167 Cornell Univ., Ithaca, N.Y.
HIGH PRESSURE–HIGH TEMPERATURE STUDY OF SPIN LATTICE RELAXATION IN PURE AND DOPED LiBr SINGLE CRYSTALS
Korukonda Linga Murty (Ph.D. Thesis) 1970 100 p
Avail: Univ. Microfilms Order No. 70-12638

Measurements of Li-7 spin-lattice relaxation time in lithium bromide single crystals as a function of temperature are reported. Results indicate that spin relaxation is mainly due to diffusive motion above room temperature. These temperature dependence measurements also allowed determination of activation energies for creation and motion of vacancies in the material. The low temperature slopes of normalized frequency yielded a 0.33 ev activation energy for motion of a vacancy, while the high temperature slope indicated a 1.7 ev activation energy of formation of a Schottky pair. Both values are in good agreement with ionic conductivity data. The effect of pressure on longitudinal relaxation time at various temperatures up to 5 kbars yielded a 6.4 cc/mole activation volume for the motion of a vacancy and a value of 29.5 cc/mole for the activation volume for creating a Schottky pair at high temperatures. Although never obtained experimentally before, these values are in essential agreement with analytical predictions. Finally, static line broadening investigations revealed the existence of predominant quadrupole interactions with imperfections in these crystals and allowed determination of dislocation densities. Dissert. Abstr.

N71-30168# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
AN EXPERIMENTAL STUDY OF THE VIBRONIC AND ELECTRONIC RESONANCE RAMAN EFFECT IN SEMICONDUCTOR AND GARNET CRYSTALS
Ronald L. Wadsack (Ph.D. Thesis) Mar. 1971 163 p refs
(Contract N00014-67-A-0097-0005)
(AD-722701; TR-5) Avail: NTIS CSCL 20/12

The work describes the first observation of resonant cancellation of Raman scattering from lattice vibrations in CdS and electronic levels in DyAlG. Previous experimental measurements and theoretical predictions had indicated that the Raman scattering cross section should increase monotonically as the energy of the incident radiation approached that of a fundamental electronic transition of the crystal. Essential to this investigation was the availability of a multi-wavelength source of intense monochromatic light. A sensitive Raman spectroscopy system was constructed which employed a flowing-gas cw argon-krypton-xenon laser. A control of 22 lasing transitions was achieved; the maximum output power was 0.65W at 514.5 nm. Samples were mounted in a liquid nitrogen cold-finger dewar. Right-angle scattering was employed with the scattered radiation detected by the usual combination of a tandem double-monochromator and a photomultiplier tube. A photon counter with digital/analog outputs drove an x-y recorder which displayed the resultant spectra. Author (GRA)

N71-30169 Syracuse Univ., N.Y.
PHOTON MODULATED TUNNELING
Francis Joseph Renda (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms Order No. 70-12803

Photon modulated tunneling in a thin film MOS structure of A12-A1203-Te was investigated. Cohen's model was used to account for the observed photocurrent when a positive voltage is applied to the aluminum. This model proposes that the photocurrent is due to electrons tunneling from the Te conduction band into the aluminum. Detailed analysis revealed that the observed photosignals in these structures can be the sum of three different mechanisms: a transient response which is capacitively coupled to the measuring circuit by the oxide capacitance, normal photoconductivity of the Te film, and photon modulated tunneling. Evidence is presented that significant portions of the photon modulated tunneling currents are due to the action of light unbending the bands in the Te. For positive voltages applied to the Al this will increase the number of states in the Te valence band from which electrons can tunnel into the Al. For negative voltages it will decrease the number of states in the Te conduction band into which electrons from the Al can tunnel. Dissert. Abstr.

N71-30170 California Univ., Riverside.
MAGNETIC AND TRANSPORT PROPERTIES OF RuO2 AND IrO2
William Dennis Ryden (Ph.D. Thesis) 1969 120 p
Avail: Univ. Microfilms Order No. 70-11998

Results of measurements of the electrical resistivity, Hall voltage, and magnetic susceptibility as a function of temperature for the transition metal oxides, RuO2 and IrO2 are presented. It is found that the properties for these two oxides behave in a manner similar to that of several of the metals of the fourth and fifth transition series. Measurements were made on single crystals grown by a vapor transport technique. Electrical resistance measurements were made in the temperature range 2 K–1000 K using a four probe technique. The temperature dependence of the resistivity was found to follow quite well a relation derived from the consideration of electron-electron and electron-phonon interband scattering. The magnitude of the electron-electron scattering term, and the value of a parameter, characterizing the momentum separation between bands in the case of electron-phonon interband scattering term was also determined. The Hall constants were determined at 77 K and 300 K for several orientations of the current direction in both IrO2 and RuO2. The Hall constant of RuO2 were found to be roughly isotropic while those of IrO2 were found to change sign depending on the current direction. The magnetic susceptibilities of both oxides were measured in the temperature range 4.2 K–300 K using the Faraday technique and single crystals of 10–20 milligram mass. Using the measured value of magnetic susceptibility, the Pauli paramagnetic susceptibility for both oxides was estimated and compared with the values of the Pauli from the specific heat measurements. The upper limit on the Pauli susceptibility enhancement factors appears to be 2 and 3 for RuO2 and IrO2 respectively. Dissert. Abstr.

N71-30171 Denver Univ., Colo.
DISLOCATION MOBILITY IN HEAVILY DOPED SILICON SINGLE CRYSTALS
Arnold David Paddock (Ph.D. Thesis) 1969 72 p
Avail: Univ. Microfilms Order No. 70-11931

Dislocation mobility was studied in doped silicon single crystals by amplitude dependent internal friction. The results are

compared with earlier studies of dislocation mobility in semiconductor crystals where the techniques used included plastic deformation and/or higher temperatures. The condition of lower driving force and temperature created by the selected technique allowed the dislocation to be studied for the first time without being appreciably displaced from its equilibrium position. Several models to account for macroscopic dislocation motion in terms of the elementary motion of kinks along the dislocation line are reviewed, and it is proposed that a dragging point energy barrier exists along this line which impedes the motion of the kinks. The observation that increased concentrations of donor impurity enhance dislocation mobility is confirmed in n-type silicon, and the first evidence of the effect in p-type silicon is presented. The observation of a dopant effect on dislocation mobility has led to a theory relating dislocation mobility with electron tunneling at a kink site. The experimental results are consistent with that model, but they do no confirm its uniqueness. In heavily doped semiconductor mobility studies the n and p branches on a mobility versus concentration curve separate at particular dopant concentrations. These concentrations are shown to be related to the intrinsic carrier concentrations at a given temperature for that particular material. Dissert. Abstr.

N71-30172 Illinois Univ., Urbana.
X-RAY STUDY OF TRANSFORMATION-INDUCED DEFECTS IN COBALT-NICKEL SINGLE CRYSTALS
Moinuddin Sirdar Rashid (Ph.D. Thesis) 1969 158 p
Avail: Univ. Microfilms Order No. 70-13454

The reversible reaction, fcc-hcp, was studied in a cobalt-30.5% nickel alloy in the transformed and deformed condition. Single crystal spheres were spark machined from cylindrical specimens, and the surface damage removed by etching. The X-ray diffraction techniques using monochromated CuK Beta radiation were used. In both structures the probability of intrinsic and growth faults, strains, and particle size introduced by plastic deformation and/or transformation were evaluated using Fourier methods, a Warren–Averbach type analysis, and a FORTRAN 2 program. Results indicate: (1) Growth faults are present in larger numbers in both the hcp and fcc structures than intrinsic faults. (2) Strains in the hcp structure are usually higher than those in the fcc structure, and the hcp and fcc transformation generally reduces the amount of strain. (3) Particle size decreases with transformation and is affected by transformation on other variants. When the specimens were transformed back to the fcc phase, the hcp to fcc transformation introduced faults on more than one variant, and there was also some evidence of the formation of extrinsic faults. Dissert. Abstr.

N71-30245# Westinghouse Research Labs., Pittsburgh, Pa.
GEISHA SEMICONDUCTOR RELIABILITY STUDIES: A PORTION OF CHAIR-GEISHA Annual Technical Report, 1 Feb. 1970–31 Jan. 1971
John R. Szedon and Karl K. Yu 22 Apr. 1971 53 p
(Contract N00014-70-C-0230)
(AD-722695; ATR-1; Rept-71-F6-EBAMP-R1) Avail: NTIS CSCL 9/1

Studies of radiation effects have been made on gate-controlled diodes with several dielectric passivation systems. Primarily, the surface generation current density increases to about the same final level regardless of its initial value. Exceptions are cases of a passivation system of silicon nitride over residual silicon oxide and certain structures with a polyimide overcoating. Results of the gate-controlled diode studies generally transfer to results on large area, two terminal GEISHA targets. At high junction current levels (> 10 (microamp)) the room temperature reverse voltage capability is not seriously reduced even after high dose irradiations (0.00026 e/sq cm, 0.024 coul/sq cm). Phosphorus gettering has been used to reduce bulk generation current effects in GEISHA targets, thus permitting their use at higher operating temperatures. Passivation using nitride films over thin oxides or protection with polyimide can preserve the low surface generation current properties of gettered material. Additional technology has been developed in patterning polyimide films and in making low thermal impedance mounts for the targets. Author (GRA)

N71-30255 Kansas Univ., Lawrence.
POSSIBLE NEW ELECTRONIC PHASE IN SEMIMETALS AND SEMICONDUCTORS
Sui-Ching Lo (Ph.D. Thesis) 1969 72 p
Avail: Univ. Microfilms Order No. 70-11046

The excitonic phase in semimetals and semiconductors was studied by including a strong electron-phonon-electron interaction term. The pure excitonic phase is found to be unstable under such a condition. The different conditions in which the electron phonon term is important are discussed. A new type of mixed phase similar to the superconducting phase could be found. The different physical implications in such a phase are studied. It is found that a partial Meissner Effect exists in this phase. The electromagnetic response of the system is also calculated. Dissert. Abstr.

N71-30256 Michigan Univ., Ann Arbor.
ON THE SPIN HAMILTONIAN OF LOW SYMMETRY CRYSTALLINE SYSTEMS
Karl Michael Beem (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms Order No. 70-14472

The theory of the spin hamiltonian is developed in a convenient form for elucidation of very low symmetry systems. Tensorial notation is stressed in order to illuminate the symmetry and similarity transformations of the hamiltonian. Together with matrix-diagonalization programs, the tensorial form provides a simple means of analysis of ESR spectra. The hamiltonian appropriate for S or = 5/2 and rhombic symmetry is extensively developed. The major emphasis is on the rather common terms of the hamiltonian, but the treatment is set up to easily incorporate additional terms. The ESR spectrum of Fe(III): LiAlSiO4 has been determined, analyzed and correlated with the crystal structure. The ESR spectrum of Mn(IV): (NH4)6NiMo9O32-8H2O has been obtained and found to verify the partial structure determination which showed the manganese to exist in an axially distorted site. Dissert. Abstr.

N71-30274*# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
STATIC DEFORMATION OF SILICA AND SILICATES
Neville L. Carter 1971 52 p refs Lunar Sci. Inst. Contrib. No. 56
(Contract NSR-09-051-001; Grant NSF GA-15412)
(NASA-CR-119174) Avail: NTIS CSCL 20L

The static ductile deformational processes in naturally and experimentally deformed quartz, olivine, pyroxenes, and plagioclase are reviewed. The orientations of deformational lamellae in experimentally deformed quartz vary with temperature, pressure, and strain rate, but lamellae of only one orientation (subbasal 1) are similar in all respects to most natural lamellae. The best understood of the recovery processes, polygonization, was observed in both experimentally and naturally deformed quartz, olivine, and enstatite. Polygonization, leading to the formation of subgrains having small disorientations, occurs by the diffusion-controlled process of dislocation climb. Dry creep experiments on periodotite showed the polygon size in olivine to be dependent on stress. Syntectonic recrystallization of alpha-quartz aggregates in axially symmetric experiments is discussed. Crossed girdle fabrics, similar to those commonly observed in quartz tectonites, were produced in the alpha-field at high temperatures in experiments in which the stress and strain fields were not axially symmetric. The deformational processes induced by static and dynamic deformation of silica and silicates are compared briefly. Author

N71-30278# Milan Univ. (Italy). Istituto di Fisica.
OFF-CENTER IONS IN CRYSTAL LATTICES Final Scientific

Report, 1 Oct. 1968–30 Sep. 1970
G. F. Nardelli 31 Oct. 1970 14 p refs
(Grant EOOAR-0041-69)
(AD-722859; AFOSR-TR-71-1099) Avail: NTIS CSCL 20/12

Results under the contract concern, on one hand the individual dynamical properties of off-center ions as well as their collective behavior in polar crystals; on the other hand, the effects of the electron-phonon interaction, with a view to the Jahn-Teller effect and phononinduced polarizability of a trapped electron. Furthermore, the Dynamical Properties of Interstitials are briefly discussed, in connection with infrared and optical response. Particular attention was paid to the collective behavior of off-center substitutional defects in order to understand the conditions for the appearance of a ferroelectric order in a dilute system of randomly distributed centers in ionic crystals. The report discusses other preliminary results obtained following a new line of research, which is in progress now, i.e. surface dynamics: surface phonons, adsorption and catalytic behavior. Author (GRA)

N71-30279# California Univ., Los Angeles. Dept. of Physics.
MAGNETIC RESONANCE IN DILUTE MAGNETIC ALLOYS: HYPERFINE SPLITTING OF Ag:Er-167
R. Chui, R. Orbach, and B. L. Gehman 1970 15 p refs
(Contract N00014-69-A-0200-4006)
(AD-722711) Avail: NTIS CSCL 20/12

The hyperfine splitting of the erbium localized moment resonance line in silver metal has been observed both in reflection and transmission for nominal concentrations of 28, 65, 86 and 1,500 ppm solid solution Ag:Er alloys. A hyperfine coupling constant A = 75 plus or minus 1.0 oersteds was found to fit the individual line positions to within experimental accuracy. Author (GRA)

N71-30281*# Translation Consultants, Ltd., Arlington, Va.
THE KINETIC THEORY OF COMPTON SCATTERING BY RELATIVISTIC ELECTRONS [KINETICHESKAYA EORIYA KOMPTONOVSKOGO RASSEYANIYA RELYATIVISTSKIMI ELEKTRONAMI]
V. M. Charugin Washington NASA Jul. 1971 10 p refs Transl. into ENGLISH of Acad. of Sci., USSR. Inst. for Space Res. report Pr-43
(Contract NASw-2038)
(NASA-TT-F-13738; Pr-43) Avail: NTIS CSCL 20H

Compton scattering by relativistic electrons, with induced scattering taken into consideration, is reviewed. The latter results in Compton reabsorption, limitating the brightness temperature of the scattered radiation. Compton reabsorption is shown to begin when brightness temperature is comparable to electron energy. Induced scattering results in intensification of the scattered radiation. Compton reabsorption source parameters are calculated. It is shown that if the cutoff in the infrared spectrum from pulsar NP 0532 is the result of Compton reabsorption, the angular dimensions of the radio, optical, and X-ray emission regions would be 10 to the minus 16th power rad (corresponding to linear dimensions of 1.2 × 1 million cm). Author

N71-30345# California Univ., Los Angeles.
NUCLEAR RELAXATION IN DILUTE MAGNETIC ALLOYS
B. Giovannini, P. Pincus, G. Gladstone, and A. J. Heeger 1970 33 p refs Sponsored in part by NSF Prepared in cooperation with Pennsylvania Univ.
(Contract N00014-69-A-0200-4006)
(AD-722710) Avail: NTIS CSCL 20/12

The various mechanisms for the magnetic relaxation of nuclei via magnetic impurities in metals are discussed and compared with each other. It is shown that two of the mechanisms proposed earlier can be derived in a unified way in the random phase approximation, and this leads to a clear understanding of the physics involved and of the possible extensions. The possible importance of the mechanisms involving direct dipolar coupling and pseudo-dipolar coupling (via the conduction electrons) is pointed out. A comparison is made with the available data on the CuMn and the CdMn systems, and a serious discrepancy between theory and experiment is pointed out. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-29392# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THERMAL CHARACTERISTICS OF ROCKET JET CONTAINING ALUMINA PARTICLES [CARACTERISTIQUES THERMIQUES D'UN JET DE FUSEE CONTENANT DES PARTICULES D'ALUMINE]
Jean Crabol 1970 39 p refs In FRENCH; ENGLISH summary
(ONERA-Publ-133) Avail: NTIS

Two methods of measurement have been devised to determine the temperature of the particles and gases contained in the exhaust products of a propulsion unit using an aluminum containing solid propellant. In measurements made on a micro-propulsion-unit, the radiation characteristics of the jet were theoretically evaluated, thus enabling the values of some alumina radiation constants to be determined. The results help to estimate the amount of energy radiated by a propulsion unit of fixed dimensions and characteristics. Author (ESRO)

N71-29410*# National Aeronautics and Space Administration, Washington, D.C.
DESIGN OF PRESSURIZED-GAS PROPELLANT-FEED SYSTEMS
In its Design of Liquid Propellant Rocket Eng. 1971 p 151–174 (See N71-29405 17-28)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21I

The design parameters for a pressurized gas propellant feed system for liquid propellant rocket engines are presented. Four major types of pressurized feed systems are: (1) stored gas systems, (2) propellant evaporation systems, (3) systems evaporating nonpropellants, and (4) systems using products of chemical reactions. Numerical analyses and comparisons of various systems are reported. P.N.F.

N71-29411*# National Aeronautics and Space Administration, Washington, D.C.
DESIGN OF TURBOPUMP PROPELLANT-FEED SYSTEMS
In its Design of Liquid Propellant Rocket Eng. 1971 p 175–261 (See N71-29405 17-28)
Avail: NTIS HC $6.00/MF $0.95 CSCL 13K

The design parameters and characteristics of turbopump systems for transfer of liquid rocket propellants are presented. Turbopump feed systems require only relatively low pump inlet pressures and permits considerable savings in tank weights due to reduced pressurization requirements. Turbopump performance and range of operation of typical pumps are discussed. The applications of turbopump machinery fuel systems are described. P.N.F.

N71-29413*# National Aeronautics and Space Administration, Washington, D.C.
DESIGN OF PROPELLANT TANKS
In its Design of Liquid Propellant Rocket Eng. 1971 p 329–352 (See N71-29405 17-28)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21I

The design parameters and configurations of tanks for storing liquid rocket propellants are discussed. Propellant tanks are categorized, according to vehicle application, as follows: (1)

prepackaged storable liquid systems, (2) booster stage systems, and (3) upper stage systems. The typical applications of various types of propellant storage systems are described. P.N.F.

N71-29414*# National Aeronautics and Space Administration, Washington, D.C.
DESIGN OF INTERCONNECTING COMPONENTS AND MOUNTS
In its Design of Liquid Propellant Rocket Eng. 1971 p 353-381 (See N71-29405 17-28)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The design parameters and characteristics of interconnections and mounts for liquid rocket propellant fuel systems are described. Design requirements are influenced by an optimum balance between low pressure drop and flexibility and structural integrity. Because of the many forces acting upon ducts, restrainers against buckling are frequently required. Typical installations of interconnectors and system designs are presented. Author

N71-29578*# Rocketdyne, Canoga Park, Calif.
TWO PHASE FLOW LH2 PUMP INDUCERS
J. A. King *In* NASA. Marshall Space Flight Center Proc,: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 75-119 (See N71-29576 17-28)
(Contract NAS8-25069)
(B-71-21) Avail: NTIS HC $6.00/MF $0.95 CSCL 21I

The design, performance characteristics, and testing of a two-phase hydrogen pump inducer are described and illustrated, and the mathematical model utilized in developing the inducer is presented. Such equipment is unpressurized tanks, saturated propellants, and multiple starts in zero gravity environment that necessitate pumping of two-phase hydrogen. All mathematical models considered were based on a constant quality flow process, since inducer entry time is assumed to be insufficient for the two phases to reach equilibrium. Isothermal gas models were eliminated due to poor agreement with available data, and a flow model in which the gaseous phase is a perfect gas was selected. Experimental design testing yielded results in generally good agreement with analytical predictions and gave evidence of superior performance characteristics in comparison with the J-2 Mark 15 inducer. A.C.R.

N71-29579*# National Aeronautics and Space Administration, Huntsville, Ala.
SATURATED LH2 TURBOPUMP OPERATION
H. P. Stinson *In its* Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 121-145 (See N71-29576 17-28)
Avail: NTIS HC $6.00/MF $0.95 CSCL 13K

The saturated LH-2 turbopump - LOX/LH-2 engine operation is described and illustrated to demonstrate the feasibility of zero-tank NPSH (net positive suction head) using J-2 engine and S-4B hardware. The two-phase test program to evaluate J-2 hydrogen pump and J-2 engine performance is discussed, along with the desirability of the zero-tank NPSH operational mode. Results support use of this mode with hydrogen systems; and future applications are recommended, particularly for the space shuttle auxiliary propulsion system. A.C.R.

N71-29580*# Martin Marietta Corp., Denver, Colo.
CHARACTERISTICS OF FEED SYSTEM INSTABILITIES
Robert D. Vaage *In* NASA. Manned Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 147-171 (See N71-29576 17-28)
(Contract NAS8-26266)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21I

Characteristics of feed system instabilities are discussed, and procedures for developing an analytical model to predict the amount of cavitation compliance that will occur in a new turbopump are described. Such a model enables POGO (structure-propulsion system coupled, longitudinal oscillations) stability analysis of vehicles before actual construction and testing of the turbopump, thus contributing to test mission safety and initial design optimization. Numerical solution of compressible flow equations, assuming thermodynamic equilibrium, is achieved, which yields vapor fraction determinations for each fluid element. Test data analyses are performed to assemble and compare results, derive a range of compliance, and perform empirical evaluation of results. Model verification is achieved by comparing model predictions and test results, and an assessment can then be made of basic analytical assumptions. A.C.R.

N71-29582*# Southwest Research Inst.
MINIMUM PRESSURE LOSS IN HIGH VELOCITY FLOW DUCT SYSTEMS
C. R. Gerlock *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 199-227 (See N71-29576 17-28)
(Contract NAS8-21133)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Theoretical and experimental investigation of ducting and ducting components to minimize pressure drop, surge pressures, and vibration levels in spacecraft feed systems is reported. In order to improve flow conditions in such systems, concentrated effort was placed on bellows flow-induced vibrations for gaseous and liquid (including cryogenic) systems. The following conclusions were reached from theoretical analyses and test data: (1) bellows flow excitation is caused by the structure-vortex coupling potential; (2) excitation conditions are predictable by Strouhal number; (3) stress levels are predictable from mathematical models; (4) a simplified form of model, when correlated with failure cases, allows fatigue prediction; (5) heat input with cryogenic flows can suppress bellows flow excitation; (6) acoustic resonance with gas flows can produce serious force amplification; and (7) test fluid substitutions must be considered with care. A.C.R.

N71-29585*# Rocketdyne, Canoga Park, Calif.
TITANIUM PUMP IMPELLER FABRICATION AND TESTING
J. E. Wolf *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 289-324 (See N71-29576 17-28)
(Contracts NAS8-20761; NAS8-25860)
(BC-71-26) Avail: NTIS HC $6.00/MF $0.95 CSCL 13K

The design, fabrication, and testing of a high speed centrifugal impeller for high pressure liquid hydrogen pumps are discussed and illustrated. Using forged titanium alloy, the impeller was developed to overcome undesirable hydrodynamic limitations on impeller design imposed by current machining practices. Specific objectives were to: (1) develop shrouded impeller fabrication techniques not limited by machining procedures; (2) design and fabricate two test impellers using these techniques; and (3) test the impellers to evaluate hydrodynamic performance and to determine structural characteristics. In comparing the resulting diffusion-bonded impeller with the Mark 29F shrouded impeller assembly, superior performance is noted for ceramic stress coat testing and room temperature burst tests. The measured H-Q performance is also in good agreement with design predictions and demonstrates the practicality of this method of fabrication. A.C.R.

N71-29592*# Marquardt Corp., Van Nuys, Calif.
SPACE SHUTTLE ACPS SHUTOFF VALVE
H. Wichmann *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 501-562 (See N72-29588 17-28)
(Contract NAS3-14349)
Avail: NTIS HC $9.00/MF $0.95 CSCL 13K

Results are presented of a tradeoff study which analyzed various types of sealing closures, actuators, and supporting parts

to determine what types of components are most suitable for the APS valve requirements. Also described is the sealing closure screening program being conducted to experimentally support this phase. Eight different types of sealing closures which were fabricated and test evaluated by means of a rapid screening tester to determine their capability of meeting the 100 scc/hr maximum of helium leakage requirement are described. Author

N71-29593*# Rocketdyne, Canoga Park, Calif.
SPACE SHUTTLE ACPS SHUTOFF VALVE
G. M. Smith *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 563–612 (See N71-29588 17-28)
(Contract NAS3-14350)
Avail: NTIS CSCL 13K

A description is given of the program being conducted to develop technology and design criteria necessary to successfully design and fabricate an APS propellant valve. The contract design requirements are: (1) operating life of 1 million cycles; (2) maximum internal leakage of 100 scc/hr; (3) zero maintenance; (4) 30 ms maximum response; (5) operating temperature from 200 to 850 R; and (6) valve inlet pressure of 20 + or − 5 psia low pressure system and 400 + or − 50 psia high pressure system. Author

N71-29607*# General Electric Co., Philadelphia, Pa.
H2 FUEL SYSTEM INVESTIGATION
W. Collier *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 3 28 Apr. 1971 p 1191 1224 (See N71-29603 17-28)
Avail: NTIS CSCL 21I

Progress in designing and developing an air breathing engine system for space shuttle application is reported. Tasks included a parametric evaluation of various engine cycles employing hydrogen fuel; an engine design study; engine development plan and cost estimate; and performance specification. All work is completed, and a derivative of the F-101 engine was recommended and used as the referenced engine. While the hydrogen versus jet propulsion fuel evaluation is not yet complete, it appears that the use of hydrogen requires additional development in the fuel handling system and related control and accessory areas. No basic technological barriers were identified, however, for fitting an engine of this type to the desired application. A.C.R.

N71-29610*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE CRYOGEN TECHNOLOGY
Charles C. Wood *In its* PROC.: Space Transportation System Propulsion Technol. Conf., Vol.4 28 Apr. 1971 p 1265–1273 (See N71-29609 17-28)
Avail: NTIS CSCL 21I

Cryogenic technology is generalized for space shuttles, including main and auxiliary propulsion, life support, and auxiliary power systems. A graphical representation is used to show systems engineering, hardware design, manufacturing, and servicing aspects of the technology status as related to the space shuttle program. J.A.M.

N71-29611*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
ORBITAL CRYOGENIC ACQUISITION AND TRANSFER
Morton H. Blatt *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 4 28 Apr. 1971 p 1275–1310 (See N71-29609 17-28)
(Contract NAS8-21465)
Avail: NTIS CSCL 21I

Low gravity propellant control using capillary devices in large scale cryogenic vehicles, as related to cryogenic acquisition and transfer devices for space shuttles, is presented. Fluid dynamic considerations are discussed, including settling, residuals, refilling, retention, wicking, spilling, and venting. Thermal conditioning problems centered on thermodynamic vent system cooling of capillary devices and feedlines with consideration of destratification, wicking, liquid collection, and tank pressure control. Shuttle mission requirements are also given, and technology studies required to supplement fluid, thermal, and structural design information are reviewed. Author

N71-29612*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ZERO GRAVITY INCIPIENT BOILING HEAT TRANSFER
H. Merte, Jr. (Mich. Univ., Ann Arbor) and J. W. Littles *In its* Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 4 28 Apr. 1971 p 1311–1348 refs (See N29609 17-28)
Avail: NTIS CSCL 21I

A procedure was developed to compute the pressure rise in a closed cylindrical container whose side walls are subjected to an imposed heat flux. The model takes into account the heat capacity of the wall. With self pressurization the heated wall is shown to be higher in temperature than the liquid-vapor interface, hence the liquid in contact with the heated wall becomes superheated. The degree of superheat was found to be dependent on the local heat flux, fluid properties, system configuration, and local fluid velocity. Author

N71-29613*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ZERO GRAVITY PROPELLANT TRANSFER
Eugene P. Symons *In its* Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 4 28 Apr. 1971 p 1359–1377 refs (See N71-29609 17-28)
Avail: NTIS CSCL 21I

The results of propellant transfer studies concentrating on zero gravity liquid transfer between unbaffled cylindrical tanks having either flat or hemispherical ends are reviewed. Typical interface configurations during outflow from cylindrical tank in zero gravity, outflow distortion, vapor ingestion, prediction of incipience of vapor ingestion in weightlessness by outflow Weber number, and residual fraction weightlessness are presented in graphical form. J.A.M.

N71-29614*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
RECENT DEVELOPMENTS IN HIGH PERFORMANCE INSULATION PURGE SYSTEMS FOR SHUTTLE APPLICATION
G. Frederickson, D. Krause, P. Klevatt, and J. Navickas *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 4 28 Apr. 1971 p 1379–1409 ref (See N71-29609 17-28)
Avail: NTIS CSCL 22A

A multilayer insulation is investigated for the orbital maneuvering propulsion system tank of the earth orbiting shuttle. The cross range EOS cryogenic tank configuration was found to affect the protection system. A tradeoff analysis and a weight analysis of the insulation was performed. An in-atmosphere protection system for the shuttle tanks is discussed. An electromagnetic probe was identified as a promising approach which is compatible with purged multilayer insulation configuration. J.A.M.

N71-29618*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE CRYOGEN TECHNOLOGY PROGRAM
Charles C. Wood *In its* Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 4 28 Apr. 1971 p 1481–1500 (See N71-29609 17-28)
Avail: NTIS CSCL 21I

The cryogenic components of the shuttle cryogen program are listed, along with the vacuum jacket ducting technology problems and objectives. Life test methodology, in-orbit multilayer insulation,

hard shell insulation, self evacuated panels, and stage/GSE systems analysis are also noted. J.A.M.

N71-29628# Georgia Inst. of Tech., Atlanta.
COMPLEX METAL HYDRIDES. HIGH ENERGY FUEL COMPONENTS FOR SOLID PROPELLANT ROCKET MOTORS Annual Report, 1 Mar. 1970 – 28 Feb. 1971
E. C. Ashby 16 Apr. 1971 159 p refs
(Contract N00014-67-A-0159)
(AD-722374) Avail: NTIS CSCL 7/3

The report is comprised of the following papers of which the last six are reprints: Concerning the preparation of HMgAlH4 and HMgBH4; Concerning the reactions of lithium and sodium aluminum hydride with grignard reagents in diethyl-ether; Complex metal hydrides of magnesium--preparation and characterization of MMgRnH(3-n)compounds; Concerning the preparation of alkylmagnesium hydrides; Synthesis of N-trialkylborzines from phenyl borate, aluminum and hydrogen and primary amines; Reaction of lithium aluminum hydride with secondary amines in diethyl ether; Preparation of new complex metal hydrides--K2ZnH4 and Na2ZnH4; A convenient and economic route to reactive magnesium hydride; The Direct Synthesis of aminoalanes; The composition of complex metal hydrides in polar solvents-tertiary amines; Concerning the reaction of lithium aluminum hydride with diethylmagnesium in diethyl ether; Reaction of aluminum hydride with diethylmagnesium in tetrahydrofuran; and the Preparation of potassium trihydridomagnesiate, KMgH3. GRA

N71-29730# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISCUSSION OF RECENT PROPELLANTS: SELECTED PARTS
D. D. Kulinich 22 Dec. 1970 51 p Transl. into ENGLISH from the book "Slovo o Raketnom Toplive" Moscow, Izd-Vo Ministerstva Oborony SSSR, 1969, p 37 – 82
(AD-722301; FTD-HT-23-873-70) Avail: NTIS CSCL 21/2

A wide range of fuels and oxidizers are mentioned in this discussion of rocket propellants. Heat combustion is compared for carbon, hydrogen, kerosine, ethyl alcohol, hydrazine, and boron as well as the petroleum products Prop. T-1, Prop. TS-2, Prop. T-2, heavy kerosine, and gasoline B-70. Heating capacity and specific thrust are compared for kerosine, alcohol, hydrogen, and hydrazine with combustion in liquid oxygen. Heat of combustion and heating capacity are discussed for Li, C, Mg, Be, and B. Single-component and unitary propellants are defined, propellant feed systems are described, and solid propellants are discussed and compared. GRA

N71-29809 Princeton Univ., N.J.
EXTINGUISHMENT OF SOLID PROPELLANTS BY RAPID DEPRESSURIZATION
Charles L. Merkle (Ph.D. Thesis) 1969 213 p
Avail: Univ. Microfilms Order No. 70-14225

An extensive series of experimental rocket motor test firings was conducted in a systematic manner to determine the rate of pressure decrease which is required to just extinguish a burning solid propellant. The boundary between extinction and non-extinction was determined for each of several propellant formulations. The boundaries are presented in terms of the initial pressure derivative and the initial chamber pressure. Specific results of the experimental testing indicate that increasing the oxidizer loading, or decreasing the oxidizer particle size, makes a propellant more difficult to extinguish. The addition of finely divided aluminum powder (at constant oxidizer to fuel binder ratio) leaves the extinction characteristics of a propellant nearly unchanged. A companion theory which describes extinction by depressurization of AP composite propellants is developed based on the granular diffusion flame theory of steady state burning. Experimental results indicate that double-base propellants are considerably easier to extinguish than are composite propellants. Dissert. Abstr.

N71-30344# Southwest Research Inst., San Antonio, Tex.
STUDIES OF INTERNAL DISPLACEMENTS IN SOLID PROPELLANT GRAINS Final Summary Report, 1960 – 1970
Robert C. De Hart, Jarvis D. Michie, and Leonard U. Restrelli Nov. 1970 49 p refs
(Contract Nonr-3363(10) (FMB))
(AD-722809) Avail: NTIS CSCL 21/9

The report is a summary of developments primarily directed toward characterizing internal displacements in solid propellant grains. Analytical procedures were developed for estimating the experimental accuracy of the X-ray detection technique in determining the distances between embedded particles. Calibrations demonstrated that magnification and length-dependent errors were actually less than those predicted analytically. Thus, measurements of behavioral phenomena could be attributed to material characteristics rather than test data errors. Author (GRA)

N71-30348*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SOLID ROCKET MOTOR IGNITERS. NASA SPACE VEHICLE DESIGN CRITERIA, CHEMICAL PROPULSION
Mar. 1971 111 p refs
(NASA-SP-8051) Avail: NTIS CSCL 21B

A summary is presented of the current knowledge on solid propellant ignition theory, followed by specific discussions of each of the igniter essential parts, their interrelationships, and the methods for evaluating them. The types of initiators, energy release systems, and associated hardware used in operational rocket motors, and some of those now in advanced development stages, are described. Design methods developed and the theoretical or empirical bases on which they are established are critically analyzed. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-29242*# Scripta Technica, Inc., Washington, D.C.
YANTAR: A FLYING ACCELERATOR [YANTAR: LETAYUSHCHIY USKORITEL]
V. Latyshev NASA Jun. 1971 4 p Transl. into ENGLISH from Grazhdanskaya Aviatsiya (Moscow), no. 3, 1971 p 15
(Contract NASw-2036)
(NASA-TT-F-13676) Avail: NTIS CSCL 21C

Yantar, a flying accelerator, is designed with a plasma-ion electrojet engine for flights at subspace altitudes carrying passengers and freight at speeds up to 29,000 km/hr. The vehicle does not require fuel; its energy source is electricity stored on the earth. A large amount of air from the upper ionosphere is scooped up by the ion engine. This configuration also opens the prospect of realizing orbital flight vehicles. Constructional layout and a picture of the vehicle are included. E.M.C.

N71-29374# Deutsche Forschungs und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antriebe.
INTRODUCTION TO THE PHYSICAL FUNDAMENTALS OF COMPRESSOR NOISE [EINFUEHRUNG IN DIE PHYSIKALISCHEN GRUNDLAGEN DES LAERMS VON AXIALVERDICHTERN]
Dieter Lohmann Dec. 1970 222 p refs In GERMAN; ENGLISH summary

(DLR-FB-70-74) Avail: NTIS; ZLDI Munich: 31.50 DM

A survey of a large number of reports on noise generated by fans and compressors is presented. A comprehensive review is given of the fundamentals of compressor aeroacoustics and the origins of compressor noise. Possibilities for reducing compressor noise are discussed. Author (ESRO)

N71-29405*# National Aeronautics and Space Administration, Washington, D.C.

DESIGN OF LIQUID PROPELLANT ROCKET ENGINES Second Edition

Dieter K. Huzel (Rocketdyne, Los Angeles, Calif.) and David H. Huang (Rocketdyne, Los Angeles, Calif.) 1971 461 p refs (NASA-SP-125) Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

CONTENTS:

1. INTRODUCTION TO LIQUID PROPELLANT ROCKET ENGINES p 1-29 (See N71-29406 17-28)

2. ROCKET ENGINE DESIGN IMPLEMENTS p 31-62 (See N71-29407 17-28)

3. INTRODUCTION TO SAMPLE CALCULATIONS p 63-79 ref (See N71-29408 17-28)

4. DESIGN OF THRUST CHAMBERS AND OTHER COMBUSTION DEVICES p 81-150 refs (See N71-29409 17-28)

5. DESIGN OF PRESSURIZED-GAS PROPELLANT-FEED SYSTEMS p 151-174 (See N71-29410 17-27)

6. DESIGN OF TURBOPUMP PROPELLANT-FEED SYSTEMS p 175-261 (See N71-29411 17-27)

7. DESIGN OF CONTROLS AND VALVES p 263-327 ref (See N71-29412 17-28)

8. DESIGN OF PROPELLANT TANKS p 329-352 (See N71-29413 17-27)

9. DESIGN OF INTERCONNECTING COMPONENTS AND MOUNTS p 353-381 (See N71-29414 17-27)

10. ENGINE SYSTEMS DESIGN INTEGRATION p 383-428 ref (See N71-29415 17-28)

11. DESIGN OF LIQUID PROPELLANT SPACE ENGINES p 429-450 refs (See N71-29416 17-28)

N71-29406*# National Aeronautics and Space Administration, Washington, D.C.

INTRODUCTION TO LIQUID PROPELLANT ROCKET ENGINES

In its Design of Liquid Propellant Rocket Eng. 1971 p 1-29 (See N71-29405 17-28)

Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The fundamentals of liquid propellant rocket engine design are presented. Subjects discussed are:(1) generation of thrust by a rocket engine, (2) gas flow processes in the combustion chamber and nozzle, (3) performance parameters, (4) properties of liquid propellants, and (5) basic elements of liquid propellant rocket engine system. Author

N71-29407*# National Aeronautics and Space Administration, Washington, D.C.

ROCKET ENGINE DESIGN IMPLEMENTS

In its Design of Liquid Propellant Rocket Eng. 1971 p 31-62 (See N71-29405 17-28)

Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The major rocket engine design parameters for liquid propellant rocket engines are presented. The major parameters discussed are: (1) thrust level, (2) performance (specific impulse), (3) run duration, (4) propellant mixture ration, (5) weight of engine system at burnout, (6) envelope (size), (7) reliability, (8) cost, and (9) availability (time table-schedule). Author

N71-29408*# National Aeronautics and Space Administration, Washington, D.C.

INTRODUCTION TO SAMPLE CALCULATIONS

In its Design of Liquid Propellant Rocket Eng. 1971 p 63-79 ref (See N71-29405 17-28)

Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The techniques used by industry in liquid propellant rocket engine systems and component design are discussed. A different propellant combination is used to permit sample calculations and designs for a number of typical propellant combinations, feed systems, and thrust levels. Schematic diagrams of three and four stage propulsion and engine systems are presented. Engine operating parameters and operational sequence charts are included. Author

N71-29409*# National Aeronautics and Space Administration, Washington, D.C.

DESIGN OF THRUST CHAMBERS AND OTHER COMBUSTION DEVICES

In its Design of Liquid Propellant Rocket Eng. 1971 p 81-150 refs (See N71-29405 17-28)

Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The design of thrust chambers and other combustion devices for liquid propellant rocket engines is discussed. Subjects presented are:(1) basic thrust chamber elements, (2) thrust chamber performance parameters, (3) thrust chamber configurations, (4) nozzle design, (5) cooling systems, (6) injector configurations, and (7) ignition devices. P.N.F.

N71-29412*# National Aeronautics and Space Administration, Washington, D.C.

DESIGN OF CONTROLS AND VALVES

In its Design of Liquid Propellant Rocket Eng. 1971 p 263-327 ref (See N71-29405 17-28)

Avail: NTIS HC $6.00/MF $0.95 CSCL 13K

The design requirements for controls and valves used in liquid propellant rocket engine systems are presented. Two basic control methods are available: (1) open-loop (no feedback) and (2) closed-loop (feedback) systems. Both systems have wide application in liquid propellant rocket propulsion systems. Open loop control is used with systems designed to operate at fixed, steady-state level over a narrow range of environmental conditions. Most other applications require one of the many forms of closed loop control. Author

N71-29415*# National Aeronautics and Space Administration, Washington, D.C.

ENGINE SYSTEMS DESIGN INTEGRATION

In its Design of Liquid Propellant Rocket Eng. 1971 p 383-428 ref (See N71-29405 17-28)

Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

Methods and techniques for integrating the systems and subsystems of liquid propellant rocket engines are presented. Subjects discussed are: (1) design integration by dynamic analysis, (2) criteria for mathematical model of engine system, (3) design integration for engine system calibration, and (4) engine system integrated performance characteristics. Author

N71-29416*# National Aeronautics and Space Administration, Washington, D.C.

DESIGN OF LIQUID PROPELLANT SPACE ENGINES

In its Design of Liquid Propellant Rocket Eng. 1971 p 429-450 refs (See N71-29405 17-28)

Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The design parameters and characteristics of liquid propellant space engines are discussed. Space engines supply all those forms of rocket propulsion which a spacecraft requires for various maneuvers in space. Liquid propellant space engine systems are divided into two basic groups: (1) vehicle main propulsion systems and (2) reaction control systems. These differ not only in function and thrust level, but also in the type of propellant used, the degree of required controllability and thrust variation, and system components. Author

N71-29500# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF JET ENGINES
A. L. Klyachkin 21 Jan. 1971 681 p refs Transl. into ENGLISH of the book "Teoriya Vozdushno-Reaktivnykh Dvigateley" Moscow, 1969 p 1 512
(AD-722283; FTD-MT-24-123-70) Avail: NTIS HC $9.00/MF $0.95 CSCL 21/5

The book examines the design operating process, principles of control and operational characteristics of jet engines of various types used in civil aviation (including turbojet, turboprop and turbofan). The classification of the engines is given. Special attention is given to the analysis of peculiarities of throttle and high-altitude and high-speed characteristics of gas-turbine aircraft engines and also the study on the effect of various operating conditions on these characteristics. Author (GRA)

N71-29521*# Martin Marietta Corp., Denver, Colo.
SPACE SHUTTLE PROPULSION SYSTEMS ON-BOARD CHECKOUT AND MONITORING SYSTEM DEVELOPMENT STUDY. VOLUME 1: SUMMARY Final Report
Mar. 1971 58 p refs
(Contract NAS8-25619)
(NASA-CR-119837; MCR-71-62-Vol-1) Avail: NTIS CSCL 21H

The development and application of analytical techniques for accomplishing the checkout and performance monitoring functions of the space shuttle propulsion systems are discussed. On board checkout requirements are concerned with preflight checkout, fault isolation, emergency detection, display, data storage, post flight evaluation, and maintenance retest. Author

N71-29522# Martin Marietta Corp., Denver, Colo.
SPACE SHUTTLE PROPULSION SYSTEMS ON-BOARD CHECKOUT AND MONITORING SYSTEM DEVELOPMENT STUDY. VOLUME 2: PROPULSION SYSTEM DEFINITION AND CRITERIA Final Report
Mar. 1971 279 p refs
(Contract NAS8-25619)
(NASA-CR-119840; MCR-71-62-Vol-2) Avail: NTIS CSCL 21H

A description of the design reference model and the analyses that were conducted to establish the space shuttle propulsion systems' checkout and monitoring criteria are presented. The design reference model is comprised of a baseline mission, vehicle, propulsion systems, and electronics systems. The mission, which includes ground as well as flight operations, was defined by establishing those events and activities which required propulsion functions. The booster and orbiter main, auxiliary and airbreathing propulsion systems were defined in terms of hardware, i.e., subsystems and component. The propulsion configuration was then related to the mission activities by defining the propulsion system functional requirements necessary to perform the mission operations. Author

N71-29523*# Martin Marietta Corp., Denver, Colo.
SPACE SHUTTLE PROPULSION SYSTEMS ON-BOARD CHECKOUT AND MONITORING SYSTEM DEVELOPMENT STUDY. VOLUME 3: OCMS CRITERIA AND CONCEPTS Final Report
Mar. 1971 393 p refs
(Contract NAS8-25619)
(NASA-CR-119838; MCR-71-62-Vol-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The leakage of propellants or pressurants aboard the space shuttle can result in hazardous conditions from fires or explosions, reduced stage performance, or functional losses of propulsion system elements. Although the level of redundancy in the propulsion systems is such that, in general, failures of single components do not adversely affect the operational capability of the stage, the failure modes and effects analyses show that leakage is a major failure mode. As a part of the definition of the propulsion system Onboard and Checkout Monitoring (OCMS), it was therefore necessary to define potential types of leaks and leakage sources and to identify an approach to leakage detection and monitoring which would accomplish the requisite functions of preflight checkout, readiness assessment and performance monitoring, and hazard warning. Author

N71-29568# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROPULSION OF HYPERSONIC VEHICLES, PARTS 1–4 [PROPULSION DES VEHICULES HYPERSONIQUES, PARTIES 1–4]
1970 124 p refs In FRENCH; ENGLISH summary Presented at Von Karman Inst., Rhode-Ste-Genese, Belg., 18–23 Jan. 1970
(ONERA-NT-169) Avail: NTIS

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1. CHOICE OF PROPULSION MODE R. Marguet p 5–21 (See N71-29569 17-28)
2. ROCKET PROPULSION M. Barrere p 23–59 refs (See N71-29570 17-28)
3. RAMJET ENGINES R. Marguet p 61–94 refs (See N71-29571 17-28)
4. AERODYNAMIC PROBLEMS R. Ceresuela p 95–122 refs (See N71-29572 17-01)

N71-29569# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CHOICE OF PROPULSION MODE [CHOIX DU MODE DE PROPULSION]
Roger Marguet *In its* Propulsion of Hypersonic Vehicles, Pt. 1–4 1970 p 5–21 In FRENCH (See N71-29568 17-28)
Avail: NTIS

Different propulsion systems such as turborocket, turbo-ramjet, air augmented rocket, ramjet rocket, and turbo-ramjet engines are described and their performance listed. Finally, some systems are selected for propulsion of hypersonic vehicles such as aircraft, nonrecoverable rocket, and space shuttle according to the mission to be performed. ESRO

N71-29570# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ROCKET PROPULSION [PROPULSION PAR FUSEE]
Marcel Barrere *In its* Propulsion of Hypersonic Vehicles, Pt. 1–4 1970 p 23–59 refs In FRENCH (See N71-29568 17-28)
Avail: NTIS

Some generalities on different rocket propulsion systems, as well as the propulsive efficiency, are given. Emphasis is made on rocket engines utilizing liquid oxygen/liquid hydrogen propellants. Finally, the thermonuclear propulsion system is described with possible applications to hypersonic flights. ESRO

N71-29571# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RAMJET ENGINES [STATOREACTEURS]
Roger Marguet *In its* Propulsion of Hypersonic Vehicles, Pt. 1–4 1970 p 61–94 refs In FRENCH (See N71-29568 17-28)
Avail: NTIS

Air intake, combustion chamber, and injector configuration effect on ramjet engine performance are dealt with. Some technical problems are reviewed. Different types of engines, including conventional, supersonic combustion, and dual mode combustion ramjet engines are studied as well as their application to hypersonic flight. ESRO

N71-29576*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS: SPACE TRANSPORTATION SYSTEM

PROPULSION TECHNOLOGY CONFERENCE. VOLUME 1: MAIN PROPULSION
28 Apr. 1971 338 p refs Conf. held at Huntsville, Ala., 6–7 Apr. 1971
(NASA-TM-X-67245) Avail: NTIS HC $6.00/MF $9.00 CSCL 21H

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1. FINAL RESULTS OF THE XLR-129 PROGRAM R. R. Atherton (Pratt and Whitney Aircraft, West Palm Beach, Fla.) p 31–73 (See N71-29577 17-28)

2. TWO PHASE FLOW LH2 PUMP INDUCERS J. A. King (Rocketdyne, Canoga Park, Calif.) p 75–119 (See N71-29578 17-27)

3. SATURATED LH2 TURBOPUMP OPERATION H. P. Stinson p 121–145 (See N71-29579 17-27)

4. CHARACTERISTICS OF FEED SYSTEM INSTABILITIES R. D. Vaage (Martin Marietta Corp., Denver, Colo.) p 147–171 (See N71-29580 17-27)

5. COMBUSTION OSCILLATIONS DAMPING DEVICES G. Garrison (Pratt and Whitney Aircraft, West Palm Beach, Fla.) p 173–197 (See N71-29581 17-28)

6. MINIMUM PRESSURE LOSS IN HIGH VELOCITY FLOW DUCT SYSTEMS C. R. Gerlock (Southwest Res. Inst.) p 199–227 (See N71-29582 17-27)

7. ENGINE ONBOARD CHECKOUT SYSTEM STUDY R. W. Vandekoppel (Martin Marietta Corp., Denver, Colo.) p 229–255 (See N71-29583 17-28)

8. LOW FREQUENCY ANALYSIS OF ROCKET ENGINES USING COMPRESSIBLE PROPELLANTS J. M. McBride (Aerojet Liquid Rocket Co., Sacramento, Calif.) p 257–288 refs (See N71-29584 17-28)

9. TITANIUM PUMP IMPELLER FABRICATION AND TESTING J. E. Wolf (Rocketdyne, Canoga Park, Calif.) p 289–324 (See N71-29585 17-27)

10. ADVANCED THRUST CHAMBER (NONTUBULAR) D. L. Fulton and C. D. Penn (Rocketdyne, Canoga Park, Calif.) p 325–361 ref (See N71-29586 17-28)

11. HIGH PRESSURE HYDROGEN EFFECTS ON MATERIALS W. McPherson p 363–378 (See N71-29587 17-06)

N71-29577*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
FINAL RESULTS OF THE XLR129 PROGRAM
R. R. Atherton *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 31–73 (See N71-29576 17-28)
(Contract F04611-68-C-0002)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

Progress on the XLR129-P-1 reusable rocket engine is reviewed. The engine is designed to provide 250,000 pounds of thrust in vacuum with a high area ratio nozzle. The size was selected to provide meaningful data that could be scaled over the range of 100,000 to 1,000,000 pounds thrust. The design of all components and the engine system is completed as well as a full-scale engineering mockup of the demonstrator engine. Tests were conducted on the preburner, main case, and fuel turbopump. The assembly and testing of two powerheads consisting of these components are reviewed along with component reusability experience. Component programs in specific areas with demonstrated reusability are: (1) wear life of critical moving components in valves; (2) fatigue life in turbopump bearings; (3) creep life of turbine blades; and (4) low-cycle fatigue life of exhaust nozzle coolant passages. The design procedures and criteria for the engine are based on those used successfully for commercial and military jet engines with proved durability and reliability. Author

N71-29581*# Pratt and Whitney Aircraft, West Palm Beach, Fla.
COMBUSTION OSCILLATIONS DAMPING DEVICES
Gary Garrison *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 173–197 (See N71-29576 17-28)
(Contract NAS8-21310)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

Damping devices for controlling combustion oscillations in rocket thrust chambers are described, emphasizing the design and performance characteristics of absorbing liners. These resonator arrays, previously used to eliminate high frequency combustion instability in airbreathing engine afterburners, have been perfected for use in rocket engines, and work is continuing to develop other types of acoustic devices including single resonators, slots, and quarter-wave tubes. Detailed descriptions are provided of absorbing liner principles, the amount of absorption required to eliminate instability, and effects of liner location and length. NASA-sponsored research into the effects of high temperatures, complex flow situations, high pressure amplitudes, and other related conditions on liner performance and design is also reviewed. A.C.R.

N71-29583*# Martin Marietta Corp., Denver, Colo.
ENGINE ONBOARD CHECKOUT SYSTEM STUDY
Richard W. Vandekoppel *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 229–255 (See N71-29576 17-28)
(Contract NAS8-25619)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

Research efforts are reported to define an approach and establish procedures, methods, and design requirements for implementation of the space shuttle propulsion systems on-board checkout and monitoring function. Only the operational phase of the space shuttle program is considered, including booster and orbiter main, auxiliary and airbreathing propulsion systems. Telemetry data link and inflight maintenance considered are excluded. Tests indicate that the onboard checkout and monitoring function is feasible for incorporation in vehicle design as long as substantial integration between propulsion and electronic systems is implemented in the basic design and emphasis is placed on minimizing quantity and complexity of sensors. It is recommended that this onboard capability be implemented as a step towards meeting program objectives of low operating cost, rapid turnaround, and high success probability. A.C.R.

N71-29584*# Aerojet Liquid Rocket Co., Sacramento, Calif.
LOW FREQUENCY ANALYSIS OF ROCKET ENGINES USING COMPRESSIBLE PROPELLANTS
J. M. McBride *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 257–288 refs (See N71-29576 17-28)
Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

A low frequency stability model, representing the case where one or more rocket engine propellants is a compressible fluid, is presented. Results for two oxygen-hydrogen rocket combustors are discussed. Also included is a discussion of the predicted effects of mixture ratio and propellant temperature.

N71-29586*# Rocketdyne, Canoga Park, Calif.
ADVANCED THRUST CHAMBER (NONTUBULAR)
D. L. Fulton and C. D. Penn *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 1 28 Apr. 1971 p 325–361 refs (See N71-29576 17-28)
(Contract F04611-70-C-0014)
(BC-71-27) Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

Experimental testing of thermal fatigue in non-tubular, regeneratively cooled thrust chambers is reported, along with attempts to develop an accurate analytical procedure for predicting their thermal durability. Long-life thrust chambers are primarily used in engines with low cycle fatigue requirements, specifically those of the Orbit-to-Orbit Shuttle and the Space Shuttle main engine, auxiliary propulsion system, and orbital maneuvering system.

Four construction materials are currently being investigated: Nickel-200, NARloy-Z, zirconium copper, and sintered nickel. Thrust chambers of each are scheduled for hot fire cyclic testing at a future date. These results are to be used along with isothermal fatigue and basic materials property data to finalize the analytical technique for predicting the cyclic life capability. A.C.R.

N71-29588*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS: SPACE TRANSPORTATION SYSTEM PROPULSION TECHNOLOGY CONFERENCE. VOLUME 2: AUXILIARY PROPULSION SYSTEM
28 Apr. 1971 660 p Conf. Held at Huntsville, Ala. 6–7 Apr. 1971
Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

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2. HYDROGEN/OXYGEN ACPS ENGINES R. Klaus (Aerojet Liquid Rocket Co., Sacramento, Calif.) p 435–458 (See N71-29590 17-28)

3. HIGH PRESSURE REVERSE FLOW ACPS ENGINE J. Senneff (Bell Aerospace Co., Buffalo, N.Y.) p 461–500 (See N71-29591 17-28)

4. SPACE SHUTTLE ACPS SHUTOFF VALVE H. Wichmann (Marquardt Corp., Van Nuys, Calif.) p 501–562 (See N71-29592 17-27)

5. SPACE SHUTTLE ACPS SHUTOFF VALVE G. M. Smith (Rocketdyne, Canoga Park, Calif.) p 563–612 (See N71-29593 17-27)

6. IGNITION DEVICES FOR ACPS S. D. Rosenberg (Aerojet Liquid Rocket Co., Sacramento, Calif.) p 613–664 (See N71-29594 17-28)

7. SPARK AND AUTO IGNITION DEVICES FOR ACPS J. R. Lauffer (Rocketdyne, Canoga Park, Calif.) p 665–758 (See N71-29595 17-28)

8. CATALYTIC IGNITION/THRUSTER INVESTIGATION R. J. Johnson (TRW Systems Group, Redondo Beach, Calif.) p 759–810 (See N71-29596 17-28)

9. AUXILIARY PROPULSION SUBSYSTEM INVESTIGATIONS J. P. McCarty p 811–844 (See N71-29597 17-28)

10. INJECTOR PERFORMANCE, HEAT FLUX AND FILM COOLING IN O2/H2 ENGINES R. K. Williams and J. E. Bouvier (NASA, Manned Spacecraft Center, Houston, Tex.) p 845–888 (See N71-29598 17-28)

11. AUXILIARY PROPULSION SYSTEM DEFINITION STUDY H. L. Burge, D. H. Grubman, R. A. Benson, and A. Shaffer (TRW System Group, Redondo Beach, Calif.) p 889–944 (See N71-29599 17-28)

12. AUXILIARY PROPULSION SYSTEMS DEFINITION STUDY R. J. Kelly (McDonnell-Douglas Co., St. Louis, Mo.) p 947–998 (See N71-29600 17-28)

13. ACOUSTIC CAVITY USE FOR CONTROL OF COMBUSTION INSTABILITY C. L. Oberg, T. L. Wong, and W. M. Ford (Rocketdyne, Canoga Park, Calif.) p 999–1040 (See N71-29601 17-28)

14. NONCIRCULAR INJECTOR ORIFICES AND ADVANCED FABRICATION TECHNIQUES R. M. McHale (Rocketdyne, Canoga Park, Calif.) p 1041–1087 (See N71-29602 17-28)

N71-29589*# Rocketdyne, Canoga Park, Calif.
HYDROGEN/OXYGEN ACPS ENGINES
G. L. Falkenstein *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 389–432 (See N71-29588 17-28)
(Contract NAS3-14352)
Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

The use of gaseous hydrogen-gaseous oxygen propellants in auxiliary propulsion engines was investigated. Included in the evaluation were: (1) thrust chamber cooling concepts; (2) gas-gas injector designs; (3) injector chamber interactions; and (4) the pulsing and steady state performance of high pressure and low pressure thrusters. Author

N71-29590*# Aerojet Liquid Rocket Co., Sacramento, Calif.
HYDROGEN/OXYGEN ACPS ENGINES
R. Klaus *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 435–458 Revised (See N71-29588 17-28)
(Contract NAS3-14354)
(AGCS-0100-71) Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

Both the high and low chamber pressure APS programs at Aerojet are covered. The majority of the discussion centers on the high pressure program as the low pressure work was suspended at an early stage in the test program. At this point in time, the high pressure program had completed the injector characterization testing and was preparing to begin cooled chamber testing. Tests results from the injector characterization tests on the high pressure program and a limited number of low pressure injector tests are presented as well as a brief review of the cooled chamber designs. Author

N71-29591*# Bell Aerospace Co., Buffalo, N.Y.
HIGH PRESSURE REVERSE FLOW ACPS ENGINE
J. Senneff *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 461–500 (See N71-29588 17-28)
(Contract NAS3-14353)
Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

The high pressure reverse flow APS engine program is in progress to assess the capability of the reverse flow engine concept for space shuttle APS application. The contract requirements include operation with gaseous H2 and O2 over a mixture ratio of 3.0 to 5.0, 1500 lbs thrust at a nominal chamber pressure of 300 psia, and a nozzle area ratio of 40:1. The nominal propellant feed temperature is 540R. Tests are also required at 800 and 300R propellant feed temperatures and chamber pressures from 100 to 500 psia. Specific goals of the effort are the attainment of 97% C* and 435 seconds specific impulse with a thrust chamber assembly capable of performing one million firings. Previous development work demonstrated the reverse flow engine concept with a combustion efficiency of approximately 95% at a mixture ratio of 4:1. The initial test firings of the program have concentrated on oxidizer and fuel injection modifications to improve the percentage of theoretical C* achieved. The development effort is limited to the thrust chamber assembly. Commercially available engine valving and ignition systems are employed for the thrust chamber testing. Author

N71-29594*# Aerojet Liquid Rocket Co., Sacramento, Calif.
IGNITION DEVICES FOR ACPS
S. D. Rosenberg *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 613–664 Revised (See N71-29588 17-28)
(Contract NAS3-14348)
(AGCS-0100-71) Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

Results of a program conducted to obtain basic ignition data on spark and plasma torch ignition methods at operating conditions typical of the space shuttle Auxiliary Propulsion System and to complete a preliminary design of an optimum ignition system based upon the test results are described. The work was comprised of: (1) an analytical and experimental program of design, fabrication and testing of gaseous hydrogen-gaseous oxygen ignition system with data obtained for wide ranges of operating conditions; and (2) the completion of a preliminary design of an ignition system. Author

N71-29586*# Rocketdyne, Canoga Park, Calif.
SPARK AND AUTO IGNITION DEVICES FOR ACPS
J. R. Lauffer *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 685–758 (See N71-29588 17-28)
(Contract NAS3-14351)
(BC-71-24) Avail: NTIS HC$9.00/MF$0.95 CSCL 21H

The use of oxygen and hydrogen propellants in the Space Shuttle Auxiliary Propulsion System (SS/APS) has established unique ignition system requirements. As many as 50 thrusters must be ignited reliably up to 1 million times each with a minimum of interference with other systems. Ignition systems for SS/APS have been investigated analytically and experimentally. An improved augmented spark igniter and a new auto-ignition device have been evaluated in detail. The systematic engineering investigation conducted for both ignition concepts is described. The preliminary design concept, laboratory tests, igniter design(s), igniter only testing, ignition/thruster ignition testing, and the overall ignition system design are discussed. An improved augmented spark igniter design with very low power requirements and a uniquely packaged integrated spark plug/exciter unit which minimizes weight and eliminates R.F.I. is presented. An auto-ignition device employing a resonance heating phenomenon and requiring no external electrical power or catalytic material is also presented. Author

N71-29587*# TRW Systems Group, Redondo Beach, Calif.
CATALYTIC IGNITION/THRUSTER INVESTIGATION
R. J. Johnson In NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 759–810 (See N71-29588 17-28)
(Contract NAS3-14347)
Avail: NTIS HC$9.00/MF$0.95 CSCL 21H

Results of experimental and supporting analytical evaluations of catalyst bed operational limitations, igniter scaling criteria, and delivered performance for a flightweight gaseous hydrogen-oxygen thrusters are discussed. Author

N71-29587*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AUXILIARY PROPULSION SUBSYSTEM INVESTIGATIONS
J. P. McCarty *In its* Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 811–844 (See N71-29588 17-28)
Avail: NTIS HC$9.00/MF$0.95 CSCL 21H

Some results are presented of technology investigations to establish what efforts need to be undertaken to provide the data and experience necessary to set requirements and establish designs for the Space Shuttle Vehicle Auxiliary Propulsion Subsystem (APS). The APS performs the vehicle propulsion function from the completion of main engine boost through completion of re-entry when vehicle control is accomplished by aerodynamic forces. This includes attitude control of the booster and attitude control and orbital maneuvering of the orbiter. The results and efforts described emphasize the subsystem and storage, conditioning and distribution assembly requirements and depends, for completeness, on component technology, particularly in the storage and thrustor areas, being developed in parallel efforts. Author

N71-29588*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
INJECTOR PERFORMANCE, HEAT FLUX AND FILM COOLING IN O2/H2 ENGINES
R. K. Williams and J. E. Bouvier *In its* Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 845–888 (See N71-29588 17-28)
Avail: NTIS HC$9.00/MF$0.95 CSCL 21H

The Manned Spacecraft Center at Houston, Texas, has been conducting an in-house gaseous hydrogen/gaseous oxygen rocket engine test program to gain experience with using gaseous hydrogen and oxygen as rocket engine propellants and to re-orient the facilities from the liquid, hypergolic rocket engine and engine systems. The following areas of investigation are discussed: (1) definition of important injector parameters; (2) evaluation of various injector techniques; (3) evaluation of geometry effects of combustion chambers; (4) determination of combustion chamber heating rates; and (5) evaluation of combustion chamber cooling with gaseous hydrogen. Author

N71-29589*# TRW Systems Group, Redondo Beach, Calif.
AUXILIARY PROPULSION SYSTEM DEFINITION STUDY
H. L. Burge, D. H. Grubman, R. A. Benson, and A. Shaffer *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 889–944 (See N71-29588 17-28)
(Contracts NAS8-26249; NAS9-11013)
Avail: NTIS HC$9.00/MF$0.95 CSCL 21H

The high and low pressure Auxiliary Propulsion Subsystem (APS) studies were conducted to define for both booster and orbiter elements those 02/H2 APS configurations capable of meeting the space shuttle requirements. Both programs were divided into two subtasks. In Subtask A the efforts were directed to configure and evaluate conceptual APS candidates for both booster and orbiter elements as specified in the NASA Auxiliary Propulsion Subsystem SSVDRD of 1 July 1970 wherein the APS would be capable of: (1) APS orbiter performs all vehicle angles; (2) all translation maneuvers, X Y Z; (3) all translation maneuvers except plus X translation burns less than 50 fps; and (4) all translation maneuvers except plus X translation less than 10 fps. The selected system were also evaluated in terms of: minimum new technology, simplicity, reliability, and system performance. In Subtask B selected systems from Subtask A were evaluated in detail to establish APS design requirements. The efforts were culminated with an identification of the critical technology areas for the selected cycles. Author

N71-29590*# McDonnell-Douglas Co., St. Louis, Mo.
AUXILIARY PROPULSION SYSTEMS DEFINITION STUDY
P. J. Kelly *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 947–998 (See N71-29588 17-28)
(Contracts NAS8-26248; NAS9-11012)
Avail: NTIS HC$9.00/MF$0.95 CSCL 21H

Summary descriptions of preliminary designs for both high and low pressure auxiliary propulsion systems (APS) are presented. The high pressure APS for the space shuttle orbiter was designed for all orbiter attitude control and maneuvering functions and no separate orbit maneuvering subsystem is required. The total impulse capability of the subsystem is approximately 12,700,000 lb/sec for both high and low cross range designs. A turbopump APS concept was selected as the preferred high pressure approach. The preferred low pressure APS approach was identified as one in which an orbit maneuvering subsystem (OMS) performs all high total impulse maneuvers, such as orbit circularization, plane changes, and deorbit fuctions, while the APS provides all attitude control and vernier maneuvers, such as midcourse corrections and docking. APS velocity increments of approximately 40 ft/sec maximum were determined to be the most favorable allocation of +X axis maneuvers between APS and OMS. A.L.

N71-29601*# Rocketdyne, Canoga Park, Calif.
ACOUSTIC CAVITY USE FOR CONTROL COMBUSTION INSTABILITY
C. L. Oberg, T. L. Wong, and W. M. Ford *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 999–1040 (See N71-29588 17-28)
(Contract NAS8-9868)
(BC-71-28) Avail: NTIS HC$9.00/MF$0.95 CSCL 21H

Criteria developed for the design of acoustic cavities to

suppress acoustic modes of combustion instability are presented. All of the hot firings were made with LM ascent engine-type hardware, propellants, and operating conditions. Nonetheless, the developed techniques are generally of equal applicability to space shuttle engines. Test results indicated: (1) the effectiveness and utility of acoustic cavities for suppressing acoustic modes of combustion instability have been clearly demonstrated; (2) cavity stabilization is not highly sensitive to variations in engine operating conditions or film coolant flowrate; (3) the ability to use unconventional cavities has been demonstrated; (4) a largely satisfactory analytical model for cavity design has been developed; and (5) a sound technological basis for cavity design has been developed. Author

N71-29602*# Rocketdyne, Canoga Park, Calif.
NONCIRCULAR INJECTOR ORIFICES AND ADVANCED FABRICATION TECHNIQUES
R. M. McHale *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 2 28 Apr. 1971 p 1041–1087 (See N71-29588 17-28)
(Contract NAS9-9528)
(BC-71-19) Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

Most rocket engine injector designs in existence employ circular orifices. Historically, circular orifices have been employed because of manufacturing limitations. With the advent of new fabrication techniques, injector orifices can now be fabricated by means other than conventional twist drilling. Noncircular orifices can be produced with relative ease. Because of these fabrication advances, injector design particles were re-evaluated to determine whether noncircular orifice designs can offer superior qualities either in terms of greater flexibility, lower costs, and better reproducibility, or in terms of equivalent or improved performance and injector-thrust chamber design compatibility. Results of these evaluations are presented. Author

N71-29603*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS: SPACE TRANSPORTATION SYSTEM PROPULSION TECHNOLOGY CONFERENCE. VOLUME 3: AUXILIARY POWER UNIT AND AIRBREATHING PROPULSION
28 Apr. 1971 161 p Conf. Held at Huntsville, Ala. 6–7 Apr. 1971
Avail: NTIS CSCL 21H

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1. AUXILIARY POWER UNIT: INTRODUCTION D. G. Beremand (NASA, Lewis Res. Center, Cleveland, Ohio) p 1097–1098 (See N71-29604 17-28)

2. AUXILIARY POWER UNIT DESIGN STUDIES W. L. Burriss and M. L. Hamilton (AiResearch Mfg., Co., Los Angeles, Calif.) p 1099–1122 (See N71-29605 17-28)

3. AUXILIARY POWER UNIT DESIGN STUDIES R. S. Siegler (Rocketdyne, Canoga Park, Calif.) p 1123–1190 (See N71-29606 17-28)

4. H2 FUEL SYSTEM INVESTIGATION W. Collier (GE, Philadelphia, Pa.) p 1191–1224 (See N71-29607 17-27)

5. BOOSTER AND ORBITER ENGINE STUDIES H. G. Moore (Pratt and Whitney Aircraft, West Palm Beach, Fla.) p 1225–1255 (See N71-29608 17-28)

N71-29604*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
AUXILIARY POWER UNIT: INTRODUCTION
Donald G. Beremand *In its* Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 3 28 Apr. 1971 p 1097–1098 (See N71-29603 17-28)
Avail: NTIS CSCL 21H

The program for developing a hydrogen-oxygen fueled auxiliary power unit (APU) for space vehicles is briefly summarized. Typical APU requirements are outlined, and the Phase 1 and Phase 2 contractual objectives are identified. A.C.R.

N71-29605*# AiResearch Mfg. Co., Los Angeles, Calif.
AUXILIARY POWER UNIT DESIGN STUDIES. SPACE SHUTTLE APU SYSTEM SELECTION AND PERFORMANCE
W. L. Burriss and M. L. Hamilton *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 3 28 Apr. 1971 p 1099–1122 (See N71-29603 17-28)
(Contract NAS3-14408)
Avail: NTIS CSCL 21H

Possible system configurations for the space shuttle auxiliary power unit (APU) are reviewed and recommendations made for the optimal design concept, based on performance evaluations of each candidate. Major APU requirements are to provide output hydraulic and electric power to the vehicle in accordance with specified power and altitude profiles for the booster and orbiter missions. In selecting an optimal design, primary emphasis was placed on determining the amount of propellant consumption during a vehicle mission, along with cost, reliability, and ease of maintenance. The evaluations, indicate that a recuperated hydrogen-oxygen system using high pressure gas, supplied by the vehicle auxiliary propulsion system, is the preferred concept. An alternate choice is a self-contained APU with high pressure propellant storage tanks. A.C.R.

N71-29606*# Rocketdyne, Canoga Park, Calif.
AUXILIARY POWER UNIT DESIGN STUDIES
R. S. Siegler *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 3 28 Apr. 1971 p 1123–1190 (See N71-29603 17-28)
(Contract NAS3-14407)
(BC-71-25) Avail: NTIS CSCL 21H

Progress is reported on efforts to select and synthesize an optimal space shuttle auxiliary power unit (APU) for the booster and orbiter phases. System synthesis and selection is complete, while optimization and preliminary design studies of selected configurations are currently being conducted. In accordance with specifications, flexibility is the foremost feature, with the propellant conditioning system designed to accomodate rapid changes in supply and to provide smooth and controlled flow. Safe hydraulic oil cooling is also assured under all operating conditions, along with power control adaptability. In addition, a forgiving design is utilized, in which passive elements are maximized, and the number and complexity of active controls is reduced. The control elements are based on use of existing cyrogenic valves and regulators from attitude control systems, gas generators, and ignition systems. A.C.R.

N71-29608*# Pratt and Whitney Aircraft, West Palm Beach, Fla.
BOOSTER AND ORBITER ENGINE STUDIES
H. G. Moore *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 3 28 Apr. 1971 p 1125–1255 (See N71-29603 17-28)
(Contract NAS3-14403)
Avail: NTIS CSCL 21H

Results and conclusions obtained from investigations of hydrogen-fueled air breathing engine design for space shuttle application are reported. Tasks included comparative evaluation of several candidate booster and orbiter engines, followed by a design study of the NASA selection, a derivative of the F401-PW-400 design designated as JTF22A-4(H). Potential weight reduction and performance improvement tests were conducted; the hydrogen fuel and control system was defined; and critical research areas for implementation of such engines in space shuttle vehicles were identified. Development and cost schedules were formulated, followed by preparation of performance specifications. A.C.R.

N71-29609*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS: SPACE TRANSPORTATION SYSTEM PROPULSION TECHNOLOGY CONFERENCE. VOLUME 4: CRYOGENS
28 Apr. 1971 220 p refs Conf. held at Huntsville, Ala., 6 - 7 Apr. 1971
(NASA-TM-X-67248) Avail: NTIS CSCL 21H

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1. SHUTTLE CRYOGEN TECHNOLOGY C. C. Wood p 1265 - 1273 (See N71-29610 17-27)

2. ORBITAL CRYOGENIC ACQUISITION AND TRANSFER M. H. Blatt (Gen. Dynamics/Convair, San Diego, Calif.) p 1275 - 1310 (See N71-29611 17-27)

3. ZERO (GRAVITY INCIPIENT BOILING HEAT) TRANSFER H. Merte, Jr. (Mich. Univ., Ann Arbor) and J. W. Littles p 1311 - 1348 refs (See N71-29612 17-27)

4. ZERO GRAVITY PROPELLANT TRANSFER E. P. Symons (NASA, Lewis Res. Center, Cleveland, Ohio) p 1349 - 1377 refs (See N71-29613 17-27)

5. RECENT DEVELOPMENTS IN HIGH PERFORMANCE INSULATION PURGE SYSTEMS FOR SHUTTLE APPLICATION G. Frederickson, D. Krause, P. Klevatt, and J. Navickas (McDonnell-Douglas Astronautics Co., St. Louis, Mo.) p 1379 - 1409 ref (See N71-29614 17-27)

6. EFFECT OF ENVIRONMENT ON INSULATION MATERIALS R. T. Parmley (Lockheed Missiles and Space Co., Sunnyvale, Calif.) p 1411 - 1437 (See N71-29615 17-33)

7. PPO FOAM INTERNAL INSULATION G. B. Yates and R. E. Tatro p 1439 - 1452 (See N71-29616 17-33)

8. INTERNAL INSULATION SYSTEMS FOR LH2 TANKS. GAS LAYER AND REINFORCED FOAM H. H. Barker, Jr. (McDonnell-Douglas Astronaut. Co.), J. L. McGrew, D. L. Buskirk, J. P. Gille, and J. M. Stuckey (Martin Marietta Corp., Denver, Colo.) p 1453 - 1480 (See N71-29617 17-33)

9. SHUTTLE CRYOGEN TECHNOLOGY PROGRAM C. C. Wood p 1481 - 1500 (See N71-29618 17-27)

N71-29745*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF FAST NORMAL SHOCK POSITION CONTROLS FOR A MACH 2.5 MIXED-COMPRESSION INLET
George H. Neiner, Michael J. Crosby, and Gary L. Cole Washington Jul. 1971 64 p refs
(NASA-TN-D-6382; E-5932) Avail: NTIS CSCL 21E

Simulation and experimental results are presented for several normal shock control systems using high-response (110-Hz bandwidth) overboard bypass doors. To date such control systems have used slower bypass doors (of the order of 10-Hz bandwidth). The best control, using two feedback loops and electronic compensation reduced shock motion below that without control for sinusoidal downstream airflow disturbances of up to 40 hertz. Inherent inlet dynamics constituted the main limitation on system closed-loop performance. Closed-loop control was demonstrated with the inlet terminated alternately with a long pipe, a choked orifice plate close to the diffuser exit station, and a J85-13 turbojet engine. Author

N71-29786# IIT Research Inst., Chicago, Ill.
CHEMICAL SPECIES IN ENGINE EXHAUST AND THEIR CONTRIBUTIONS TO EXHAUST ODOR Final Report, 1968 - 1970
Andrew Dravnieks and Anne O'Donnell Nov. 1970 79 p refs
(Contract CPA-22-69-98)
(PB-198072; IITRI-C6183-5) Avail: NTIS CSCL 21B

The project investigated the chemical composition of the odorants in diesel engine exhaust. Exhaust samples were collected in fluidized or packed bed collectors filled with gas chromatographic packings. Separation of the individual compounds was accomplished by two gas chromatograph columns in series. Final identification of the separated compounds was accomplished by mass spectrometry. About 100 compounds were judged to be odor relevant in diesel engine exhaust by this procedure. GRA

N71-29821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT AND TESTING OF ABLATIVE ROCKET ENGINE WITH SELECTED 7.62-CENTIMETER (3.0 IN) DIAMETER THROAT INSERTS
Jerry M. Winter, Donald A. Peterson, Arthur M. Shinn, Jr., and Albert J. Pavli Washington Jul. 1971 47 p refs
(NASA-TM-X-2315; E-6197) Avail: NTIS CSCL 21H

Five injector configurations were designed with the performance evaluated in a nitrogen tetroxide 50-percent blend of unsymmetrical dimethyl-hydrazine propellant rocket engine were tested to demonstrate long-term firing duration and restart capability. The duty cycle chosen was an initial 300-second firing, five 20-second firings and a final 300-second firing. The best throat insert material tested was zirconia reinforced with tungsten-rhenium wire. Scale-up to larger throat sizes is discussed. Author

N71-30072*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL CONTROL OF SUPERSONIC INLETS TO MINIMIZE UNSTARTS
Bruce Lehtinen, John R. Zeller, and Lucille C. Geyser Washington Jul. 1971 29 p refs
(NASA-TN-D-6408; E-6253) Avail: NTIS CSCL 21E

A method for designing supersonic inlet controls based on a desire to minimize inlet unstart is described. The design problem is formulated as one in linear stochastic optimal control and estimation. However, the performance index chosen (to be minimized) is the expected frequency of unstarts. Since this index is nonquadratic, the principle of quadratic equivalence is applied, so that the control consists of linear state variable feedback. Estimates of unmeasurable and/or noisy states required for control are then generated using a Kalman filter. Results show the sensitivity of unstart frequency to nominal normal shock position, control bypass door capacity, and measurement noise level, for white noise disturbances. Author

N71-30280*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATIONS ON A BIPROPELLANT HOT GAS ROCKET ENGINE FOR ORBIT AND ATTITUDE CONTROL [UNTERSUCHUNGEN AN EINEM ZWEISTOFF-HEISSGAS-RAKETENTRIEBWERK ZUR BAHN-UND LAGEREGELUNG (TIROC)]
L. T. Kayser Washington NASA Jul. 1971 104 p refs Transl. into ENGLISH of Stuttgart Univ., report AGRR-TB-19
(Contract NASw-2038)
(NASA-TT-F-13683; AGRR-TB-19) Avail: NTIS CSCL 21H

The investigative findings of a prototype research of the Tangential Injection and Rotational Combustion system are submitted and can serve as a reliable basis for design of a space propulsion system for any service requirement with great reliability and very low development costs. With a high specific impulse greater than 280 s these data enable the delivery of both extremely small as well as extremely large impulses. Depending on the tasking area, satellites, upper stages or space propulsion modules are fitted with 8, 10, 12 or 16 of such micro-rocket engines and then controlled fully independently to any degree of precision desired in all rotational attitudes and on any orbits selected. Of significance is the joining of the tasks of attitude control (3 degrees of freedom in rotation) and orbital control (3 degrees of freedom in translation) into one single space propulsion system. Author

N71-30339# Aeronautical Research Labs., Melbourne (Australia). Dept. of Supply.
A STUDY OF HYDRAULIC JET PROPULSION IN A DESTROYER
P. C. Manins Jul. 1970 57 p refs
(ARL-ME-316 Avail: NTIS

A design study has been made of a hydrojet, or hydraulic pump-jet, propulsion unit for a destroyer. The design procedure was incorporated into a computer program so that the effects of many design parameters could be studied. It was found that (1) the unit could be designed to be free of cavitation over the full speed range of the destroyer. As a consequence propulsion noise produced by a hydrojet destroyer would be small in comparison with a conventional destroyer, especially at high speed; and (2) the efficiency of the hydro-jet was lower than that of the conventional propeller for the same design speed but, as the efficiency of the former can be maintained for off-design operation, it is unlikely that the hydrojet would incur a significant penalty in range. The design of the impeller was found to be a crucial factor in determining the size and weight of the hydrojet unit. Author

N71-30350*# Scientific Translation Service, Santa Barbara, Calif.
BASIC STUDY OF THE AFTERBURNER
Yoshiyuki Ohya Washington NASA Jul. 1971 44 p refs Transl. into ENGLISH from Ishikawajima Harima Tech. Rept. (Japan), v. 10, no. 3, May 1970 p 229-242
(Contract NASw-2035)
(NASA-TT-F-13657) Avail: NTIS CSCL 21E

Afterburning in turbine engines, especially fan engines, has been used as an optimum means to produce both supersonic and subsonic performance of military and commercial aircraft, and is especially indispensable for supersonic flight. The major problem in the fan burner is flame stabilization at low inlet temperatures. Flame stabilizing devices, with various configurations, have been tested at atmospheric inlet conditions. It was found that V-gutter flame holders, with injection of small amount of fuels into the flame holder wake, bring about broadening of the combustible zone of air/fuel ratio. Author

N71-30376 Princeton Univ., N.J.
IGNITION TRANSIENT PREDICTION AND CONTROL OF SOLID PROPELLANT ROCKET MOTORS
William James Most (Ph.D. Thesis) 1969 212 p
Avail: Univ. Microfilms Order No. 70-14228

Research is directed toward the development of an analytical model for predicting the thrust-time curve during the entire ignition transient of a solid propellant rocket motor. The model is most directly applicable to the class of rocket motors with large port-to-throat area ratios, which are ignited by pyrogen igniters located in the forward end of the engine. The model characterizes the local ignition event by a constant critical surface temperature ignition criterion and by including a surface heat release term to account for exothermic decomposition below the critical temperature. The theoretical predictions of the model are compared to experimental test firings of a two-dimensional rocket motor and of motors with more realistic grain configurations. An extensive range of igniter system and engine design parameters are covered. Both aluminized and unaluminized propellants are considered and shown to be similar. Dissert. Abstr.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-29211# California Univ., Livermore. Lawrence Radiation Lab.
ILLUSTRATED CATALOGUE OF COSMIC X-RAY SOURCES
Frederick D. Seward Feb. 1970 32 p refs
(UCID-15822) Avail: NTIS

This catalogue was generated to help understand published X-ray astronomy data. Emphasis is on galactic sources. Location data are presented on graphs. Sources listed are of varied character ranging from precisely located sources to sources that have only been observed once under rather poor conditions. It includes sources that are highly variable in intensity and spectra. NSA

N71-29255*# National Aeronautics and Space Administration. Washington, D.C.
PROGRESS OF BALLOON HELIOPHYSICS IN THE SOVIET UNION
V. A. Krat et al Jun. 1971 18 p refs Transl. into ENGLISH from Izv. Glavnoi Astron. Observ. (Pulkovo), no. 185, 1970 p 124-131
(NASA-TT-F-13675) Avail: NTIS CSCL 03B

The Soviet stratospheric station which was used in the flights of November 1, 1966 and September 22, 1967 is discussed. Much of the effort was directed toward a study of photospheric granulation; a portion was directed toward determining the deuterium/hydrogen ratio in the solar atmosphere. Advantages of making photographs from the stratosphere rather than from the earth are discussed along with some general considerations in photographing the sun. Additionally, some of the problems involved in photography from the stratosphere are considered. The main advantage here is elimination of the effect of water vapor; a major problem is heat-up of the optical system. The physical equipment in the stratosphere station is discussed in moderate detail. Most of the description is general in nature. The equipment is of interest in that devices were provided for careful aiming at the sun during flight conditions; systems were monitored by television, and controlled by telemetry. Flights were made to an altitude of 20.4 km; observations were made for 1.5 and 3.5 hours, respectively. Photographs made totalled 461 and 953, respectively. Author

N71-29282 National Lending Library for Science and Technology, Boston Spa (England).
RESULTS OF OBSERVATIONS OF SUNSPOTS MADE WITH THE PULKOVO MAGNETOGRAPH [NEKOTORYE RESULTATY NABLYUDENII SOLNECHNYKH PYATEN NA PULKOVSKOM MAGNETOGRAFE]
R. N. Ikhsanov Dec. 1970 20 p refs Transl. into ENGLISH from Izv. Glavnoi Astron. Observ. (Pulkovo), no. 185, 1970 p 159-166
(NLL-RTS-6194) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 1.90; 6 NLL photocopy coupons

The methods used in processing observational data obtained from the Pulkovo magnetograph are reviewed. The results of the preliminary processing of observations made of two sunspot groups during 1967 are presented along with the distribution characteristics of the magnetic field and radial velocities in the sunspots. Author

N71-29472# California Inst. of Tech., Pasadena. Dept. of Physics.
COSMIC RAY INTERACTIONS (10 TO THE 11th POWER) TO (10 TO THE 13th POWER) eV
E. W. Cowan and K. Matthews 1971 30 p refs
(Contract Nonr-220(53))
(AD-721714) Avail: NTIS CSCL 4/1

A sample of 1167 single cosmic rays near sea level is analyzed from the data recorded by an interleaved stack of cloud and ionization chambers, and carbon and iron plates. The results include lossrate curves in iron and carbon, mean free path in carbon, and energy spectra of charged hadrons (largely pions) and neutrons. Author (GRA)

N71-29529# Atomic Energy Commission, New York. Health and Safety Lab.
SEA-LEVEL COSMIC-RAY NEUTRON MEASUREMENTS, 1970
Ferenc Hajnal, James E. McLaughlin, Martin S. Weinstein, and Keran O'Brien Feb. 1971 22 p refs
(HASL-241) Avail: NTIS

Low-level environmental radiation measurements by multisphere spectrometer are presented of sea-level cosmic-ray neutrons in New York City. The 0.50 mRad/y was measured, corresponding to a neutron flux of 0.0082 n/sq cm/sec. These results and those from HASL transport calculations agree fairly well with the 1966 estimates of the U.N. Scientific Committee that the annual neutron dose rate is about 0.70 mRad and the sea-level flux is about 0.010 n/sq cm/sec. Comparison of the annual dose equivalent rates was also made with published values. Because the dose equivalent rates depend strongly on the model used, different slab geometries were evaluated to determine differences between surface and depth dose equivalent values for neutrons incident both normally and isotropically, and monolaterally and bilaterally, onto a 30-cm-thick tissue slab. Author (NSA)

N71-29542# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EFFECTS OF SOLAR PARTICLE EVENTS ON THE ENERGETIC PARTICLE POPULATION IN THE EARTHS MAGNETOSPHERE
George A. Paulikas 15 Mar. 1971 43 p refs
(Contract F04701-70-C-0059)
(AD-722056; TR-0059(6260-20)-14; SAMSO-TR-71-53) Avail: NTIS CSCL 4/1

Solar particle events affect the radiation environment in space through the immediate appearance of energetic particles in regions of space usually devoid of such particles and also through subsequent perturbations of the trapped radiation zones. These perturbations are associated with magnetic storms and occur a few days after a solar event. Solar particles with energies > 50 keV have access to the earths polar caps; solar protons with energies >1 MeV reach the synchronous altitude. Magnetic storms change the fluxes of trapped particles by orders of magnitude, with the changes generally being larger at higher altitudes. Author (GRA)

N71-29709*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GENERAL FORMULA FOR THE DECAY LIFETIMES OF THE STARFISH ELECTRONS
E. G. Stassinopoulos and P. Verzarin (APL) Washington Jul. 1971 14 p refs
(Contract N00017-62-C-0604; 188-36-51-05-51)
(NASA-TN-D-6284; G-1016) Avail: NTIS CSCL 18C

A treatment based on the analysis of data from Satellite 1963 38C was developed to calculate the decay lifetimes of the artificial electrons produced by the Starfish nuclear explosion. The treatment makes use of experimental data and describes the decay lifetime tau in the form of a continuum in BLE-space. The results are valid over the entire inner zone of the trapped radiation belt. Reference maps of constant tau contours in BL-, BE-, and LE-space were constructed and are discussed. Author

N71-29724 Wisconsin Univ., Madison.
INVESTIGATION OF THREE DISCRETE COSMIC X-RAY SOURCES IN THE SCORPIUS-ARA REGION
Thomas Michael Palmieri (Ph.D. Thesis) 1969 129 p
Avail: Univ. Microfilms Order No. 70-3654

Three discrete sources of celestial X-rays have been observed with a detector system sensitive to low energy (.15-8 keV) X-rays. The data were obtained during the flight of an unguided Aerobee 150 sounding rocket. All three sources were observed on each of nine scans through the Sco-Ara region of the galactic plane. Since two positions reported here are consistent with two sources previously seen, added confidence is given to the position determination for the third source, seen on the same scans. The position of this source is not consistent with previous measurements, and the results imply that it is a new source that has not been observed before. Designated GX 341-6, it is the brightest of the three. Spectral data obtained on this source are consistent with the predictions of thermal bremsstrahlung at 1.7 keV or synchrotron emission with an exponent of 3.4. A turnover in the spectrum is observed at low energies and is interpreted as implying approximately 10 to the 22nd power hydrogen atoms/sq cm along the line of sight to the source. Dissert. Abstr.

N71-29923*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
UNIPOLAR INTERACTION OF MERCURY WITH THE SOLAR WIND; THE STEADY STATE BOW SHOCK PROBLEM
D. S. Colburn, C. P. Sonett, and K. Schwartz Jul. 1971 40 p refs
(NASA-TM-X-62028) Avail: NTIS CSCL 03B

The steady state electromagnetic interaction of the solar wind with the planet Mercury is computed for a spectrum of electrical conductivity functions using the assumption that no atmosphere or magnetic field damps the direct interaction. The form of the induction is described by the unipolar effect and corresponds to the zero frequency limit of a transverse magnetic mode. Calculations are included to determine the effective surface temperature of the planet. These calculations include the apparent motion of the sun in the Hermean sky. It is shown that a significant interaction, detectable by a space probe, is plausible for reasonable conductivity functions. The strength of the interaction is considered in terms of the subsurface thermal gradient, and computations are given relating the strength of the solar wind interaction with the conductivity parameters. Author

N71-29924*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC MATTER-ANTIMATTER ANNIHILATION AND THE GAMMA-RAY BACKGROUND SPECTRUM
F. W. Stecker, D. L. Morgan, Jr., and J. Bredekamp May 1971 39 p refs
(NASA-TM-X-65598; X-647-71-237) Avail: NTIS CSCL 03B

Initial results of a detailed calculation of the cosmological gamma-ray spectrum from matter-antimatter annihilation in the universe are presented. The similarity of the calculated spectrum with the present observations of the gamma-ray background spectrum above 1 MeV suggests that such observations may be evidence of the existence of antimatter on a large scale in the universe. Quantitative comparison of the calculations with the existing observations indicates the product of interacting matter and antimatter densities. Author

N71-30048*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
THE 1970 SOLAR-TRACKER BALLOON FLIGHTS, 3066, 3066, AND 3067 Final Report
R. D. Conlon Nov. 1970 45 p Prepared in cooperation with JPL
(Contract NAS7-100; JPL-952879)
(NASA-CR-119170; Rept-3461) Avail: NTIS CSCL 03B

High-altitude solar cell and radiometer calibrations performed during July and August 1970 using balloon techniques are reported. Solar cell modules and radiometers were flown on balloon-mounted solar trackers at a nominal 120,000-ft altitude to obtain near-zero-air-mass performance data. A total of three balloon flights were attempted. Two flights carried solar cell payloads, and one flight was made to obtain radiometric solar intensity measurements. Operational details, problems encountered, instrumentation modifications, and tabulations of secondary temperatures, calibration voltages, and time-altitude data recorded during the flights are presented. Author

N71-30089*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC GAMMA-RADIATION FROM PION DECAY: COMMENTS ON A PAPER BY CAVALLO AND GOULD
F. W. Stecker Jun. 1971 4 p refs Submitted for publication
(NASA-TM-X-65802; X-641-71-254) Avail: NTIS CSCL 03B

There is a discrepancy between previously published results and those of Cavallo and Gould on the calculated gamma-ray production spectrum arising from the decay of neutral pions produced by cosmic ray interactions with interstellar gas. This discrepancy is reexamined here with the conclusion that Cavallo and Gould have overestimated the gamma-ray production rate from this process. Author

N71-30261*# Massachusetts Inst. of Tech., Cambridge.
ROTATIONAL DISCONTINUITIES IN THE SOLAR WIND
James Marshall Turner May 1971 32 p refs
(Grant NGL-22-009-015)
(NASA-CR-119172; CSR-P-71-60) Avail: NTIS CSCL 03B

Solar wind plasma and magnetic field data from Mariner 5 are used to identify rotational discontinuities. Of the 40 discontinuities found, 36 were clustered in three distinct three to six day intervals and were characterized by high solar wind bulk velocities, high magnetic field magnitudes, low densities, and high correlation between velocity and magnetic field changes. Strong evidence that smooth Alfven waves were also present during these times was obtained. The rotational discontinuities, which are sharp-crested Alfven waves, had planes of polarization which were generally 10 – 20 deg away from the planes of polarization of the smooth Alfven waves. An examination of the qualitative features of fast plasma streams and slow plasma streams revealed several striking differences in the behavior of the magnetic field and velocity and their fluctuations, the field magnitude, and the density. It is suggested that these differences are significantly correlated with the occurrence of rotational discontinuities. Author

N71-30262*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
TANGENTIAL DISCONTINUITIES IN THE SOLAR WIND
James Marshall Turner May 1971 26 p refs Submitted for publication
(Grant NGL-22-009-015)
(NASA-CR-119173; CSR-P-71-59) Avail: NTIS CSCL 03B

Solar wind plasma and magnetic field data were used to identify tangential discontinuities during the first 40 days of the flight of Mariner 5. The normals to the tangential discontinuity surfaces had a strongly preferred orientation which was in the ecliptic plane and perpendicular to the spiral field direction. For quiet plasma streams, both the magnetic field and velocity were confined away from the discontinuity, as indicated by the fact that the least likely directions of changes in B and V near the discontinuity tended to be distributed along the normal to the discontinuity surface. In disturbed plasma streams, the magnetic field also behaved in the same manner, while the velocity confinement was only true at the discontinuity and did not persist away from the discontinuity. The least likely directions of change for the magnetic field and velocity near the discontinuities were different from the least likely directions found for the 40-day investigation. Author

N71-30380*# Translation Consultants, Inc., Arlington, Va.
DYNAMICS OF THE RADIATION BELTS OF THE EARTH
B. A. Tverskoy Washington NASA Jun. 1971 202 p refs Transl. into ENGLISH of the publ. 'Dinamika Radiatsionnykh Poyasov Zemli' Moscow, Nauka, 1968 p 6–223
(Contract NASw-2038)
(NASA-TT-F-635) Avail: NTIS CSCL 03B

The problem of corpuscular radiation effects from the sun on the earth was studied. The physical conditions in the earth's magnetosphere are examined, including the geomagnetic field, cold plasma, and electromagnetic and plasma waves in the magnetosphere. Particle drift in intraearth current field, trapped radiation region boundaries, and high energy electrons and protons are also investigated. The transfer of trapped particles across the drift shells during sudden pulses and the role of transfer in the earth's radiation belt formation are reviewed, along with radiation belt stability. J.A.M.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-29244# Joint Publications Research Service, Washington, D.C.
CONDITIONS OF STABILITY OF A SATELLITE GRAVITATIONAL STABILIZATION SYSTEM WITH GYROSCOPIC DAMPING
V. A. Sarychev 24 Jun. 1971 23 p refs Transl. into ENGLISH from Astronaut. Acta (USSR), v. 14, 1969 p 299–310
(JPRS-53447) Avail: NTIS

The basic ideas, description, and investigations of a satellite gravitational stabilization system with gyroscopic damping are presented. The general conditions for asymptotic stability of the satellite-gyroscope system's positions of equilibrium are emphasized there. It is assumed that the gravitational and aerodynamic moments that act on the satellite have three unequal principal moments of inertia. Two 2-degree gyroscopes are located in the satellite housing and their properties are utilized to provide damping of the system's natural oscillations and to obtain additional restoring moments. The equations of motion of the satellite gyroscope system are derived on an exact basis without introducing the precession theory. Author

N71-29245*# Computing Devices of Canada, Ltd., Ottawa (Ontario).
METEOROID IMPACT FLASH ANALYZER Final Report
B. Jean and R. Alexander 17 May 1971 63 p refs
(Contract NAS9-8788)
(NASA-CR-115066; R134/FR2) Avail: NTIS CSCL 03B

The determination of a correlation between the impact flash radiative properties and the impacting projectile characteristics is discussed. The goal of the present extension phase is to clarify the nature of the radiation emitted in three narrow band spectral windows and to build up statistics about the projectile parameters influence on flash characteristics. Author

N71-29252*# Scripta Technica, Inc., Washington, D.C.
PRELIMINARY DATA ON LUNAR REGOLITH RETURNED BY LUNA-16 AUTOMATIC PROBE [PREDVARITELNYYE DANNYYE O LUNNOM GRUNTE DOSTAVLENNOM AVTOMATICHESKOY STANTSIYEY LUNA-16]
Aleksandr Pavlovich Vinogradov NASA Jun. 1971 18 p refs Transl. into ENGLISH from Priroda (Moscow), no. 3, Mar. 1971 p 8–15
(Contract NASw-2036)
(NASA-TT-F-13700) Avail: NTIS CSCL 03B

Results of a preliminary investigation include granulometric data, and description of the optical properties of the regolith, and its petrography and mineralogy, as well as analyses of different parts of the core for major and trace elements. Isotopic composition of the inert gases and some other elements has been determined. The Rb/Sr age of the regolith is 4.85-4.25 billion years. Author

N71-29260*+ National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LUNAR PHOTOGRAPHS FROM APOLLOS 8, 10, AND 11
Robert G. Musgrove, comp. WASHINGTON 1971 24 p
(NASA-SP-246) Avail: SOD $4.00; NTIS CSCL 03B

The purpose of this photographic atlas is to make available to scientists and to the interested public a comprehensive sample of photographs from the first three Apollo lunar missions. This atlas contains photographs of almost every type of feature and terrain that exists on the lunar surface. Author

N71-29313# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ON THE POSSIBILITY OF UNIQUE DETERMINATION OF A MEDIUM'S PHYSICAL PARAMETERS BY RADIOSOUNDING TECHNIQUE
V. L. Azarov, L. N. Lupichev, V. I. Novojilov, E. N. Orel, and G. A. Tavrizov 1969 17 p
(D-13) Avail: NTIS

The principal possibility is shown of the unique determination of physical parameter distribution in planetary atmospheres, using radiosounding measurements. In particular the method is demonstrated for electron distribution measurement in interplanetary space. ESRO

N71-29331*# Hudson Inst., Inc., Croton-on-Hudson, N.Y.
CONTEXTUAL PLANNING FOR NASA: A SECOND WORKBOOK OF ALTERNATIVE FUTURE ENVIRONMENTS FOR MISSION ANALYSIS, VOLUME 1 Interim Report
Anthony J. Wiener, B. Bruce-Briggs, Frank Armbruster, and Arthur Springer 30 Apr. 1971 223 p refs
(Contract NAS2-5431)
(NASA-CR-114336; HI-1272/3-RR-Vol-1; IR-2) Avail: NTIS CSCL 22A

A study was undertaken to improve the capability for making preliminary selections among alternative space program objectives, particularly for long term projects. Economic, social, and political aspects are investigated, and their influence on the future of NASA's policy goals. The goals of various groups in the American society, the changes in these goals, and the evaluation of programs in terms of these goals are explored in detail. Attitudes toward science, nationalism, and internationalism are also described. It is stated that most Americans are not excited by scientific and technological advance unless they are shown that there is some reasonable and immediate chance of direct benefits. New directions for the space program to satisfy the new social, financial, and political attitudes are suggested and include international cooperation, military emphasis, earth applications, and lower cost programs. N.E.N.

N71-29332*# Hudson Inst., Inc., Croton-on-Hudson, N.Y.
CONTEXTUAL PLANNING FOR NASA: A SECOND HANDBOOK OF ALTERNATIVE FUTURE ENVIRONMENTS FOR MISSION ANALYSIS, VOLUME 2: APPENDIX: AN OUTLINE OF A NATIONAL PROFILE
Frank Armbruster 30 Apr. 1971 478 p refs
(Contract NAS2-5431)
(NASA-CR-114337; HI-1272/3-RR-Vol-2; IR-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

An attempt is made to determine what the national attitudes are and how, or if, they are changing, based almost entirely on primary data. The basic attitudes, particularly those which are considered to have received inadequate attention, are discussed in detail with respect to three groups: the population as a whole, youth, and Negroes. Youth and Negroes were singled out as minorities receiving much attention. Emphasis is on youth, and a special subgroup of students is also studied. The work force, new technology, the environment of the space program, and competition for Federal money are also considered, and indicators for NASA planners and a prognosis of the future space program environment are discussed. N.E.N.

N71-29352# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
RADIO MAP OF THE CRAB NEBULA AT 3.5 mm
L. I. Matveenko 1970 20 p refs In RUSSIAN and ENGLISH
(PR-47) Avail: NTIS

The Crab nebula was observed at a wavelength of 3.5 mm with the 36-foot NRAO Kitt Peak radio telescope, and the radio map which was obtained is described. ESRO

N71-29353# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
DETERMINATION OF ORBIT AND ATTITUDE OF ARTIFICIAL PLANET SATELLITE AND SOME GRAVITY AND ASTRONOMICAL CONSTANTS FROM EARTH-BASED RADIO DOPPLER AND ORBITAL PHOTOGRAMMETRIC OBSERVATIONS
E. P. Alekseshin, J. L. Ziman, I. V. Isavnina, V. A. Krasilov, and B. V. Nepoklonov et al 1969 16 p refs Presented at the 20th Congr. of the Intern. Astronautical Federation, Mar del Plata, Arg., 5–12 Oct. 1969
(D-8) Avail: NTIS

The problem of simultaneously treating earth-based radio Doppler observation of an artificial planetary satellite (APS) and photogrammetric observation of the planet's surface and stars from the satellite is considered. Position and attitude of the APS are determined as well as coordination, vector of rotation and parameters of the planetary gravity field. A planetocentric coordinate system is constructed and coordinates of a number of points are computed. ESRO

N71-29354# Technische Hochschule Munchen (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
THEORY OF SATELLITE ORBITS, PART 2 [THEORIE DER SATELLITENBAHNEN, 2. TEIL]
M. Schneider Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Jan. 1971 57 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-05) Avail: NTIS; ZLDI Munich: 11.55 DM

The Lagrange method of the variation of constants is presented. This idea is then applied to derive the perturbation equations associated with the classical elements of an elliptical Keplerian orbit. Author (ESRO)

N71-29355# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL CONTRIBUTION TO THE PROBLEM OF OPTIMAL RENDEZ-VOUS BETWEEN MASSIC PLANETS [CONTRIBUTION NUMERIQUE A L'ETUDE DES RENDEZ-VOUS OPTIMAUX ENTRE PLANETES MASSIQUES]
Jean-Pierre Peltier 1970 102 p refs In FRENCH; ENGLISH summary
(ONERA-NT-167) Avail: NTIS

Qualitative differences between solutions to the problem of two-impulse rendez-vous between planetary orbits and known solutions to the corresponding problem of rendez-vous between vacant orbits are investigated. This investigation makes use of results about corresponding mono-impulsive interception problem (flyby) which are simpler. Numerical examples are given to illustrate Earth-Mars rendez-vous. The optimality of all trajectories is studied in the light of Lawden's primer vector theory. "possible optimality domains are computed for each problem and mutually compared. The question of the optimality of trajectories using terminal coast periods about planetary orbits is raised. Some examples of trajectories (having up to five impulses) are cited to prove that certain bi-impulsive rendez-vous trajectories may satisfy all classical necessary conditions for optimality and yet be non-optimal on the whole. Such examples are now within the context of the problem of rendez-vous between coplanar circular orbits. Author (ESRO)

N71-29380# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

OPTIMAL STRATEGY SELECTION FOR ORBIT DETERMINATION

B. T. Bahsian and P. E. Eljasberg 1969 24 p refs Presented at the 20th Congr. of the Intern. Astronautical Federation, Mar del Plata, Arg., 5–12 Oct. 1969

(D-5) Avail: NTIS

The problem of simultaneous selection of an optimal orbit determination strategy and an optimal set of useful information on measured parameter values. This problem is solved for two extreme cases: (1) for the most unfavorable correlation dependence between D sub i measurement errors, and (2) for the uncorrelated undisplaced errors. The problem is applied to an Earth-Mars transfer trajectory. ESRO

N71-29400# Joint Publications Research Service, Washington, D.C.

ASTRONOMY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 255 28 Jun. 1971 p 1–8 (See N71-29399 17-34)

Avail: NTIS

News briefs and abstracts of scientific articles concerning astronomy are presented. Topics discussed include: solar radiation, reflection of sunlight by the Venus atmosphere, review of meteor literature for the period 1957 to 1970, Martian observations, and radio emission of Saturn. F.O.S.

N71-29418# Royal Aircraft Establishment, Farnborough (England).

PROD, A COMPUTER PROGRAM FOR PREDICTING THE DEVELOPMENT OF DRAG-FREE SATELLITE ORBITS. PART 1: THEORY

G. E. Cook Jan. 1971 20 p refs

(RAE-TR-71007) Copyright. Avail: NTIS

The basic theory underlying the computer program PROD for predicting the long-term development of drag-free orbits of eccentricity up to about 0.9 under the influence of the earth's gravitational potential and the gravitational attractions of the sun and moon is presented. To prevent excessive use of computer time, the disturbing functions are averaged analytically with respect to the mean anomaly of the satellite and recurrence relations are given wherever possible for the evaluation of the various coefficients. Author (ESRO)

N71-29419# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

LUNAR SURFACE REFLECTION COEFFICIENT IN A RADIOWAVE

N. N. Krupenio 1969 16 p refs In RUSSIAN and ENGLISH

(PR-4) Avail: NTIS

Variations of the dielectric constant of the lunar surface are calculated from the variations of the reflection coefficient with wavelength, as measured by radar echoes and using Fresnel's formula. These data are used to calculate the upper layer density change for the lunar central region. ESRO

N71-29426# Naval Research Lab., Washington, D.C.

REPORT OF NRL PROGRESS, MAY 1971

May 1971 48 p refs

Avail: NTIS

CONTENTS:

1. ANALYSIS OF SUBMARINE ATMOSPHERES F. E. Saalfeld, R. A. Saunders, and F. W. Williams p 1–9 refs (See N71-29427 17-06)

2. APPLICATION OF A SLOW WAVEGUIDE TO A FREE FLOODED RING TRANSDUCER W. J. Trott p 10–15 refs (See N71-29428 17-07)

N71-29487# Royal Aircraft Establishment, Farnborough (England).

ORBIT DETERMINATION AT THE ROYAL AIRCRAFT ESTABLISHMENT

R. H. Gooding Nov. 1970 21 p refs Presented at the ESRO Summer School on Spacecraft Operations, Gravenbruch, West Ger., Aug. 1970

(RAE-TM-SPACE-156) Copyright. Avail: NTIS

The development of a series of computer programs for the orbit determination of earth satellites is described. Author (ESRO)

N71-29761 Princeton Univ., N.J.

THE GRAVITATIONAL FIELD OF A PARTICLE FALLING IN A SCHWARZSCHILD GEOMETRY ANALYZED IN TENSOR HARMONICS

Frank J. Zerilli (Ph.D. Thesis) 1969 167 p

Avail: Univ. Microfilms Order No. 70-14251

We look at the problem of a small particle falling in a Schwarzschild background ("black hole") and its spectrum in the high frequency limit are examined. In formulating the problem it is essential to pose the correct boundary condition: gravitational radiation not only escaping to infinity but also disappearing down the hole. The problem in the approximation of linear perturbations from a Schwarzschild background geometry, utilizing the decomposition into the tensor spherical harmonics is discussed. Dissert. Abstr.

N71-29764 National Lending Library for Science and Technology, Boston Spa (England).

PECULIARITIES OF THE ENERGY DISTRIBUTION IN THE ULTRAVIOLET ZONE OF THE SPECTRUM BETA LYRAE [OSOBENNOSTI V RASPREDELENII ENERGII V ULTRAFIOLETOVOI OBLASTI SPECTRA BETA LYRAE]

V. Ya. Alduseva Oct. 1970 18 p refs Transl. into ENGLISH from Soobsh. Gos. Astron. Inst. (Moscow), no. 162, 1970 p 38–50

(NLL-RTS-6031) Avail: Natl. Lending Library, Boston Spa, Engl.: 34s; 6 NLL photocopy coupons

Absolute spectrophotometric gradients in photographic and ultraviolet spectral zones were determined. A dependence of the spectrophotometric gradient on the light phase was detected; the behavior of the phase 1 and phase 2 gradients, however, was in anti-phase. A qualitative interpretation of the results is given, which is concerned with the variation in effective temperature and electron density with the distorted surface of the main component B9 caused by rotation and tidal effects. Author

N71-29798* National Lending Library for Science and Technology, Boston Spa (England).

AN INVESTIGATION OF INTERSTELLAR LIGHT ABSORPTION AND SPATIAL DISTRIBUTION OF STARS IN TWO REGIONS OF THE MILKY WAY IN THE CONSTELLATIONS AQUILA AND SCUTUM [ISSLEDOVANIE MEZHZVEZDNOGO POGLOSCHENIYA SVETA I PROSTRANSTVENNOGO RASPREDELENIYA ZVEZD V DVUKH UCHASTKAKH MLECHNOGO PUTI V SOZVEZDIYAKHORLA I SHCHITA]

S. P. Apriamashvili Oct. 1970 29 p refs Transl. into ENGLISH from Byull. Abastumansk Astrofiz. Observ. (USSR), no. 30, 1964 p 49–69

(NLL-RTS-6052) Avail: Natl. Lending Library, Boston Spa, Engl.: 56s; 9 NLL photocopy coupons

The distributions of the light absorbing media in two regions of the Milky Way were computed by the color excess method. The two regions are l = 4 deg and b = −2 deg (4 deg square), and l = 356 deg and b = 0 deg (8 deg square). Each region was divided into three zones, and the curves were drawn giving the total absorption variation with the distance. The spatial distribution features of early-type stars (O to B5) are studied. The results are compared with radio astronomical observations. Author

N71-29824 Ohio State Univ., Columbus.
A CLASS OF HIGH ENERGY, CLOSE APPROACH TRAJECTORIES WITHIN THE THREE-BODY PROBLEM
James Lawrence Kamm (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms Order No. 70-14048

Uniformly valid, asymptotic approximations for the motion of a massive body in a trajectory that is constrained to pass close to one member of a double mass system are developed. The transient body is required to have large energy typical of interstellar trajectories implying a rapid encounter with the double star system. The perturbation parameter is derived from the two-body trajectory of the transient body about the combined double star when the body is far from the binary. The perturbation parameter sigma is the ratio of the distance between the primaries and the semilatus rectum of the two-body reference trajectory. The problem is solved by the method of matched asymptotic expansions. This technique shows that the asymptotic solution separates into three distinct regions; the approach region, where the first order motion is the reference trajectory; the encounter region, where the motion is fundamentally two-body motion about the encountered primary mass; and the departure region, where the motion is primarily a two-body conic about the center of mass of the double star.
Dissert. Abstr.

N71-29828 California Univ., Berkeley.
EARLY SOLAR SYSTEM ABUNDANCES OF IODINE-129 AND PLUTONIUM-244 FROM ANALYSIS OF XENON IN NEUTRON-IRRADIATED METEORITES
Frank Anthony Podosek (Ph.D. Thesis) 1969 72 p
Avail: Univ. Microfilms Order No. 70-13137

The results of mass-spectrometric analyses of the xenon released in several stages of heating of a group of neutron-irradiated meteorites are presented. Analysis of meteoritic xenon is useful for many reasons, but the primary interest here is the information such experiments provide about the early solar system abundances of two extinct radioactivities: I(127) (17 million year half-life) and Pu(244) (82 million year half-life), both of which decay to isotopes of xenon. The neutron-irradiation also produces isotopes of xenon from I(127) and U(235) present in the meteorite. Since I(129) and I(127) occupy the same crystal lattice sites, their xenon decay products will be released in constant proportion, at least from the more gas-retentive mineral locations.
Dissert. Abstr.

N71-29843*# Translation Consultants, Ltd., Arlington, Va.
NEW DATA ON THE FIGURE AND RELIEF OF THE MOON FROM THE PROCESSING OF ZOND-6 PHOTOGRAPHY [NOVYYE DANNYYE O FIGURE I REL'EFE LUNY PO REZUL'TATAM OBRABOTKI FOTOGRAFIY DOSTABLENNYKH]
S. N. Rodionov et al Washington NASA Jul. 1971 29 p refs Transl. into ENGLISH from Russian report PR-41, 1970 34 p
(Contract NASw-2038)
(NASA-TT-F-13737) Avail: NTIS CSCL 03B

The content and results of processing Zond-6 photography of the moon's western hemisphere are presented. The coordinates of the images of lunar formations and limbs were measured on the photographs. Concurrent statistical processing of the measurements resulted in the obtaining of the shape and dimensions of the lunar limbs perpendicular to those seen from the earth, and in the refinement of the selenographic coordinates of the control points and of the lunar chart in the central portion and on the far side of the western hemisphere. Previously unknown formations were discovered in the south pole region, and on the far side of the moon.
Author

N71-30014# Australian National Univ., Canberra.
ASTROPHYSICAL INVESTIGATION OF FOUR CLASSICAL CEPHEID VARIABLE STARS
Edward G. Schmidt (Ph.D. Thesis) 1969 396 p refs
(NP-18720) Avail: AEC Depository Libraries

The properties of the variable Cepheids gamma Ophiuchi, U Sagittarii, S Normanae, and eta Aquilae were examined. A study of H alpha profiles suggests that they are an effective indicator providing a fast accurate method of determining temperature variation and giving agreement with photometric results, although profiles are effected by absorption in cooler Cepheids. The effect of line blocking on the B−V colors of yellow supergiants showed some difference between the blanketing of different Cepheids at the same temperature due to turbulence and gravity differences. Curves of growth and fine analyses of gravity agreed within the limitations of the methods assuming that during part of the cycle atmospheres are not in quasi-hydrostatic equilibrium. If masses are calculated on the assumption that there is hydrostatic equilibrium for the rest of the cycle, then they are in agreement with the evolutionary tracks.
NSA

N71-30033# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 181
22 June 1971 37 p refs Transl. into ENGLISH from Polish, Rumanian, and Yugoslavian reports
(JPRS-53428) Avail: NTIS

A review of scientific developments in East European countries is presented. Subjects discussed are: (1) Polish geological exploration, (2) Soviet space technology findings, (3) development of ultrasonic flow detector, (4) operation of computer, (5) development of science in Romania, and (6) description of tactical aircraft used in European countries.
P.N.F.

N71-30063# Minnesota Univ., Minneapolis.
PROPER MOTION SURVEY WITH THE FORTY-EIGHT INCH SCHMIDT TELESCOPE. 27: THE SOUTH GALACTIC POLE
Willem J. Luyten 15 Jan. 1971 9 p
(Contract Nonr-5060(00); Grant NSF GP-9506)
(AD-722342) Avail: NTIS CSCL 3/3

The paper gives tables of data on the measurement of proper motion of stars in the vicinity of the South Galactic pole.
GRA

N71-30084 California Univ., Los Angeles.
ON THE DETERMINATION AND OPTIMIZATION OF POWERED SPACE VEHICLE TRAJECTORIES USING PARAMETRIC DIFFERENTIAL CORRECTION PROCESSES
Johnny Lee Junkins (Ph.D. Thesis) 1969 232 p
Avail: Univ. Microfilms Order No. 70-14282

Several computationally efficient differential correction processes are developed and compared. These processes are applied to the solution of the multiple point boundary value problems which arise when designing trajectories for powered space vehicles. The formulation utilizes the analogy between trajectory design and orbit determination successive approximation processes. This analogy appears only when the unknown control functions are represented in parametric forms; thus restructuring the problem such that the unknowns are the parameters contained in the assumed forms of the functions, rather than the functions themselves. The resulting system of non-linear parametric equations can often be solved by successive approximation procedures once preliminary values of the parameters are available. Differential correction processes are proposed and applied to illustrative and practical problems.
Dissert. Abstr.

N71-30118*# National Aeronautics and Space Administration. Ames Research Center, Moffet Field, Calif.
MARTIAN DOUBLET CRATERS
Verne R. Oberbeck and Michio Aoyagi Jul. 1971 40 p refs

(NASA-TM-X-62027) Avail: NTIS CSCL 03B

A large number of Mars craters exist that are nearly tangential to other craters. They occur in clusters or as isolated crater doublets. Results of probability calculations and a Monte Carlo cratering simulation model show conclusively that many of the Mars craters could not have resulted from random single body impact. However, clusters and doublets could be caused by meteoroid breakup resulting from stresses induced in the meteoroid by the gravitational field of Mars. Calculations are provided that show the required relationships between mass, entry angle, impact velocity, and tensile strength of the meteoroid, and the separation distance between the centers of the resulting craters relative to crater sizes. It is concluded that under certain conditions, doublets should be produced on Mars as a direct result of breakup of an impacting meteoroid. The impact process can yield nonrandom crater distributions that should be observed in different degrees of development on different planetary surfaces. Thus, distributions of large craters on different planetary bodies cannot be compared directly for interpretations of the geologic history of one planetary surface relative to another. Author

N71-30211# Australian National Univ., Canberra.
DEEP SKY SURVEY AT 2700 MHz
Jasper V. Wall (Ph.D. Thesis) 1970 365 p refs
(NP-18682) Avail: AEC Depository Libraries

The 210-foot telescope of the A.N.R.A.O. was used in a survey of the +4 deg to −4 deg declination zone to a source density of 450/sterad, and six selected regions to a source density of 2500/sterad. A description of the survey, the measurement (at 2700 MHz) of positions and flux densities of the sources, and the programs of optical identification and spectral observations are given. The statistics of the source spectra are examined, and the 2700-MHz number−flux density relation (between 30/sterad and 2500 sterad) is derived. Finally, a simple numerical approach to investigate the significance of number−flux density relations is described. The technique enables the computation of the relation at a given frequency with the incorporation of any geometry, radio luminosity function, type of evolution, or form of radio spectrum. Using the identification and spectral data for the sources in the 2700-MHz survey, the number−flux density relations are computed for two uniform models of the Universe, and the results are compared with the observed relations. Author (NSA)

N71-30333# Grumman Aerospace Corp., Bethpage, N.Y. Geo-Astrophysics Section.
SIZE CLASSIFICATION OF MARS SIMULATION SAMPLES
Walter G. Egan Jun. 1971 25 p refs Submitted for publication
(RM-512J) Avail: NTIS

A detailed physical analysis was made of a particulate sample (1.19 to 2.38 mm American Society for Testing and Materials (A.S.T.M.) sieve range Venango County, Pa. limonite) shown previously to produce the best optical and physical match to the Martian bright areas. An A.S.T.M. sieve size range as a particulate specification is an ambiguous parameter, and inadequate to describe the particulates when a subsidiary distribution of fines occurs. The 1.19 to 2.38 mm limonite particles were actually flake shaped, with an overcoating of less than 0.5 micron diameter platelet particles; the flake shaped particles had over-all length, width, and thicknesses of 3.44, 2.83, and 1.16 mm, respectively, and a specific surface area of 0.077 sq m. The specific surface area was 70 times the projected area of the particles, and could be caused by less than 1 percent by weight, relative to the 1 to 2 mm particles, of an equivalent less than 1 micron limonite powder. Scanning electron microscope photographs revealed a surface roughness between 0.02 and 10 microns. Author

N71-30367# Joint Publications Research Service, Washington, D.C.
A BIBLIOGRAPHY OF SOVIET LITERATURE ON AVIATION, ALPINE AND SPACE BIOLOGY AND MEDICINE
A. A. Sergeyev, comp. 10 Jun. 1971 441 p Transl. into ENGLISH of the book "Otechestvennaya Literatura po Aviatsionnoy, Vysokogornoy, i Kosmicheskoy Biologii i Meditsine. Bibliografiya" Leningrad, Nauka Publ. House, 1969 p 3−190
(JPRS-53329) Avail: NTIS HC$6.00/MF$0.95

The bibliography contains over 5000 entries, covering a period from 1885 through 1967. A subject index is given for such topics as hypoxia, physiology, psychology, acceleration stresses, weightlessness, drugs, and decompression sickness. N.E.N.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-29420# Naval Weapons Lab., Dahlgren, Va.
ACCURACY OF DOPPLER DETERMINATIONS OF STATION POSITIONS
R. J. Anderle Apr. 1971 48 p refs
(AD-722172; NWL-TR-2559) Avail: NTIS CSCL 8/5

Locations of Doppler satellite observing stations were revised to obtain a set which is more self-consistent and more consistent with the CIO pole. Residuals of satellite observations for 1970 were analyzed using the new coordinates to determine mean and standard errors for five days of observations of components of station position versus station, time of day, and elevation angle. The accuracy of the determination of a component of station position is about 4 meters at moderate and high elevation angles. But since more satellite passes occur at lower elevation angles, the accuracy of determination of a component of position based on five days of observation of one satellite is only about 2 meters. Author (GRA)

N71-29483*# General Electric Co., Philadelphia, Pa.
REUSABLE EXTERNAL INSULATION TPS FOR THE SPACE SHUTTLE
P. D. Gorsuch, R. A. Tanzilli, and D. E. Florence *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 39−93 (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

A series of high insulative efficiency, rigidized fibrous insulation materials have been developed and evaluated. Thermal protection systems (TPS) based on these materials are much lighter in weight than those using other candidate materials such as coated refractory metals. This weight saving is extremely important since it can be used to increase the payload weight fraction of the space shuttle vehicle. The designation for this class of materials is Reusable External Insulations (REI). The inherent simplicity, low density, capability for repeatedly surviving the maximum expected surface temperatures during normal entry missions without significant performance degradation and reserve margin are the strong forcing functions (1) for the development of REI materials and (2) for establishing their multimission capability for use in space shuttle TPS. The ultimate goal of the development and evaluation program is an REI TPS with a 100 mission capability. Author

N71-29484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METALLIC HEAT SHIELD MATERIALS FOR SPACE SHUTTLE
Robert W. Hall *In its* NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 95−118 (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

The current status of metallic heat shield materials being investigated for use on the space shuttle is discussed. Materials for thermal protection systems (TPS) are emphasized rather than heat shield design or evaluation because it is in the materials area that the most progress has been made. The materials investigated were: (1) titanium; (2) superalloys; (3) dispersion strengthened NiCr; (4) coated Columbium; and (5) coated tantalum. Author

N71-29455*# Grumman Aerospace Corp., Bethpage, N.Y. Structural Mechanics Section.
CREEP OF METALLIC THERMAL PROTECTION SYSTEMS
Harry G. Harris and Kenneth N. Morman, Jr. *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 119–161 refs (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22H

Results are presented of an effort to correlate creep analysis with observed creep behavior in Haynes-25 TPS panels under simulated mission environment. An analysis based on the assumption that the TPS material will creep continuously over a total design life of 100 missions (25 hours) without experiencing the effects of the load and temperature interruption of each mission indicated a considerable discrepancy with the test results. An effort to pinpoint the apparent anomaly between theory and experimentation led to a detailed investigation of: (1) the effect of using different creep theories (the Nadai law and the Pao-Marin theory); (2) material oxidation during elevated temperature testing; (3) the effect of residual stresses; (4) magnitude of biaxial stress effects in the bead; and (5) the validity of ignoring the effects of periodic loading and heating. The most reasonable correlation with panel test results occurred when the cyclic effect of loading and heating on the material behavior were incorporated into the analysis. Tests on uniaxial creep coupons indicate that the Haynes-25 material will exhibit nearly the same creep behavior in each mission as the virgin material; for example, there is no memory effect of the temperature and strain history of previous missions. Results show that allowable creep stresses must be limited to levels which accumulate approximately 0.1% creep strain in 25 hours exposure to heat and load in order to meet a maximum 0.5-inch permanent deformation per 20 inches. Author

N71-29456*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ABLATIVE THERMAL PROTECTION SYSTEMS
L. F. Vosteen and C. M. Pittman *In its* NASA. Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 163–194 refs (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

One of the most difficult space shuttle technology problems is the development of light weight reliable thermal protection systems with a multi-mission life. A need for minimizing weight has been well established and reliability is essential to any manned system. A multi-mission life is desirable to minimize operational costs during the life of the vehicle. As an alternative to a multi-mission life, however, total program costs could be kept to a minimum if the thermal protection system could be made sufficiently inexpensive so that it could be discarded after every flight and replaced. Ablative materials are obviously a prime candidate for such a system. The rationale for using ablators and the status of a technology program directed at producing inexpensive ablative heat shields are discussed. Author

N71-29457*# Avco Corp., New York. Systems Div.
ABLATIVE LEADING EDGE DESIGN CONCEPTS FOR THE SHUTTLE ORBITER
John W. Graham, David A. Mosher, and Ira Victor (Grumman Aerospace Corp.) *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 195–231 (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

Results of preliminary efforts in the design of an ablator leading edge for the shuttle orbiter are summarized. Design considerations, refurbishment concepts, analysis, and test results are discussed along with significant conclusions. Author

N71-29458*# Martin Marietta Corp., Denver, Colo.
BOOSTER THERMAL PROTECTION SYSTEM EVALUATION
Allen M. Norton *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 233–249 (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

The basis for the evaluation of the thermal protection system (TPS) candidates for the booster was to develop design charts of the response of the various TPS candidates to the flight environment. The maximum levels of the thermal and pressure distributions over the booster exposed surface were derived from the aerothermal environment. Then, the design charts were utilized in conjunction with environmental distribution maps to obtain the total weight of each TPS candidate. In addition, the costs of the various TPS candidates were estimated so that the final selection of the booster TPS could be obtained by optimizing both cost and weight. This is extremely important because the TPS represents approximately 13% of the booster's inert weight and 37% of the maintenance and turnaround cost for the booster. Author

N71-29459*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
THE HEAT SINK CONCEPT FOR THE SPACE SHUTTLE BOOSTER
Jack Prunty *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 251–269 (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

Current findings of an investigation of a heat sink structural concept applied to the space shuttle booster are presented. The concept is compared with the more generally accepted thermally protected arrangement, and comparative weight and cost data are presented. Substantiating data and problem discussions are confined to the heat sink concept. It will be recognized that the limited effort accomplished to date on the heat sink concept probably implies a lesser understanding of the associated problems compared to those of the thermal protection system (TPS) concept, and that, conversely, the heat sink approach may be amendable to improvement when given further consideration in certain areas. Author

N71-29460*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
COMPARISON OF ACTIVE AND PASSIVE THERMAL PROTECTION SYSTEM WEIGHTS FOR A DELTA BODY ORBITER
H. D. Schultz and F. L. Guard *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 271–300 ref (See N71-29451 17-17)
Avail: NTIS HC$9.00/MF$0.95 CSCL 22B

A study was accomplished which compares active and passive thermal protection system (TPS) weights for a delta-body orbiter for crossrange up to 1500 nautical miles (n.mi.). Two heat shield designs were considered: (1) a clip-supported metallic heat shield with 96-kg/cu m Dyna-Flex insulation; and (2) LI-1500, an all-silica, rigid insulation being developed by Lockheed. In all cases, an aluminum primary structure with 370 K temperature limit was assumed. For the passive systems, insulation was sized as a function of crossrange. For the active systems, TPS insulation thickness and hardware were optimized for minimum weight at 1500 n.mi. The reduction in expendable coolant and auxiliary power unit fuel weights was then computed for shorter crossranges. The active TPS is a redundant, indirect active cooling system which uses water-glycol as the transport fluid, and water and ammonia as expendable coolants. Principal conclusions were: (1) Regardless of crossrange an active TPS with LI-1500 heat shield is the lightest

weight of the four TPS concepts analyzed. (2) An active TPS is roughly one-half as weight sensitive to crossrange as a passive TPS. (3) For both LI-1500 and metallic heat shields, the passive TPS is about 1225 kg heavier than the active TPS at 200 n.mi. crossrange and about 2500 kg heavier at 1500 n.mi. Author

N71-29461*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ENVIRONMENTAL TESTING FOR EVALUATION OF SPACE SHUTTLE THERMAL PROTECTION MATERIALS AND SYSTEMS

Howard K. Larson, Frank J. Centolanzi, Nick S. Vojvodich, Howard Goldstein, M. Alan Covington et al *In its* NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 301–333 (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The environmental simulation testing and evaluation of shuttle thermal protection materials and systems at the Ames Research Center are discussed. Conclusions reached as a result of these investigations were: (1) An order of magnitude reduction in time and costs compared to past experience was deemed necessary for this program. (2) Experimental data coupled with theoretical analysis have shown that appropriate flow simulation is necessary for evaluation of nickel-chromium alloys and extrapolation to flight conditions. (3) Simultaneous testing of eight different material samples at the same heating rate has disclosed a wide variation in surface temperature due to surface emissivities differing as much as 0.2. This must be taken into consideration in the planning of tests, interpretation of data, and application of the results to vehicle design. (4) The necessity for supersonic turbulent boundary layer simulation test facilities was determined. Author

N71-29462*# Grumman Aerospace Corp., Bethpage, N.Y.

COMMENTS ON THE NASA DESIGN CRITERIA DOCUMENT

I. G. Hedrick *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 335–354 refs (See N71-29451 17-17)

(NASA-SP-8057) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The design criteria document was prepared by a combined industry/NASA/Air Force committee, and presents general and mission-oriented structural criteria for the space shuttle. Thus, at the appropriate time, the document will provide information useful in drawing up contractual documents for Phases C and D of the shuttle program. In view of the many new and challenging problems associated with the shuttle structure, the objectives are partially satisfied within the document, but considerable work remains to be done in some areas. In particular, four issues needing further investigation are: (1) utilizing probabelistic methods to determine limit loads and factors of safety; (2) influence of flaw growth and fracture mechanics considerations on selecting factors of safety; (3) fail-safe/safe-life dilemma; and (4) the POGO problem. Author

N71-29463*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STRUCTURAL ANALYSIS AND AUTOMATED DESIGN

Harvey G. McComb, Jr. *In its* NASA. Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 355–390 refs (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The present state-of-the-art in structural analysis and design is reviewed, the direction in which the technology is progressing is indicated, and applications to shuttle structures are discussed. Examples are drawn from aircraft and space vehicle structures technology to characterize the state-of-the-art. New results on shuttle-type structures are shown to illustrate applications of the latest technology. Certain specific computer programs are identified to clarify present and expected future capabilities. The programs mentioned are not necessarily unique nor are they necessarily the best of their type. They are simply representative examples. Discussed in detail are: (1) finite element and finite difference methods of analysis; (2) fixed structure and loading design; and (3) combined discipline analysis and design. Author

N71-29464*# McDonnell-Douglas Co., St. Louis, Mo.

CRITICAL STRUCTURAL DESIGN TRADE STUDIES SPACE SHUTTLE SYSTEM

T. P. Brooks *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 391–465 (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Results are presented of trade studies performed on the straight wing low crossrange and delta wing high crossrange baseline orbiters. Integral vs. non-integral tanks and common vs. separate tank bulkheads were for the straight wing orbiter baseline. Recommendations of these studies have been incorporated in the design of the delta wing orbiter because the arrangement of delta orbiter body structure is similar to that of the straight wing orbiter studied. Comparison of forms of integral stiffening was based upon the baseline delta wing orbiter and single body canard booster. Results of this study are directly applicable to the present baseline vehicles. Conventional materials were baselined for all shuttle structures. Composite material applications have been studied for the orbiter only. Aluminum alloy 2014-T6 was the selected baseline material for orbiter and booster main cryogenic propellant tanks. Values of $28K/lb for the orbiter and $5.6k/lb for the booster were used to evaluate weight saving in terms of dollars. This dollar value for unit weight indicates the program cost for system resizing to maintain a fixed payload capability. Author

N71-29465*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

APPLICATION OF BERYLLIUM TO ORBITER PRIMARY STRUCTURE

T. J. Harvey and A. E. Trapp *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 467–495 (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

In evaluating the effects of advanced material use, Lockheed chose beryllium for the structure on the basis of trade studies which indicate that this material results in the minimum weight system. The high modulus-density ratio and the excellent elevated temperature characteristics of beryllium permit maximum savings in lightly loaded structure and in thermal protection insulation thickness. Beryllium was also found to be in the most advanced state of development, with a long record of successful space flight applications. Results indicated that considerable cost savings may be possible by application of advanced materials, providing the cost estimating relationships are valid. The studies indicated that reduced system complexity would result because the large reduction in launch weight achieved immediately reduces the size and complexity of the propulsion system. Also, as structural weight is reduced, wing loading, reentry heating, landing speeds, aerodynamic balance, and other benefits are achieved. Author

N71-29466*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

DESIGN, MANUFACTURE AND TESTING OF A TD NICKEL-CHROMIUM STRUCTURAL ASSEMBLY

Read Johnson, Jr. and Charles L. Ramsey (AFFDL) *In* NASA. Manned Spacecraft Center NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 497–525 (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The work conducted has contributed significantly to an understanding of the material performance capabilities and manufacturing characteristics of TD NiCr. Also, the current series of ascent and reentry profile tests being conducted is providing a timely base of data to assess the performance of a large manufactured TD NiCr assembly and to establish a demonstrated capability to design with this class of materials. Author

N71-29467*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN AND TEST OF ADVANCED STRUCTURAL COMPONENTS AND ASSEMBLIES
E. E. Engler and C. E. Cataldo *In its* NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 527-583 (See N71-29451 17-17)
Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

In the development of structural concepts for planned new vehicle systems, such as the space shuttle, proof of concept through design, fabrication and test of large components and assemblies is an important link in the technology program. All areas of development, from material and analysis method research, advanced design, manufacturing technology, cost, NDI, and testing are combined into one program. Two structural technology areas of special interest for the space shuttle are discussed: (1) development of TPS/primary structure interaction; and (2) application of advanced composites for primary structures. The two programs have as goals the establishment or reliable TPS/primary structural design and the demonstration of the feasibility of the design of tests, and the determination of whether or not advanced composites have a defined place in the planned space shuttle stages. Several individual technology tasks are underway in these areas and considerable progress has been made. In general, the materials have been selected and the basic structural design concepts developed, but construction of test components, test facilities, and testing analyses have not progressed as well as originally anticipated. Details on the status of the programs and some results obtained to date are reported. Author

N71-29468*# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Div. de Mecanique Aerospatiale.
DETECTOR AND GUIDANCE OF A DRAG-FREE HELIOCENTRIC SOUNDING DEVICE [DETECTEUR ET PILOTAGE D'UNE SONDE HELIOCENTRIQUE A TRAINEE COMPENSEE]
Nov. 1970 118 p refs In FRENCH
(Contract ESTEC-1032/70/HP)
(ONERA-NT-1/1673/SY) Avail: NTIS

A drag-free system has been developed for an heliocentric sounding capsule intended to test certain aspects of the relativistic theory. The design of a capacitive detector with increased cavity is discussed. The perturbations on the test mass due to the relative movement device/mass are evaluated. An attitude control system using cold gas jet is also discussed. ESRO

N71-29469*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ATTITUDE ESTIMATION AND CONTROL OF EARTH-POINTING SATELLITES
Willi Kortuem Dec. 1970 154 p refs
(DLR-FB-70-76) Avail: NTIS; ZLDI Munich: 37,80 DM

Attitude estimation and control of earth-pointing satellites in circular orbit are treated assuming horizon sensor and gyro measurements and on-off jet torquers for control. For attitude determination an improved orbital gyrocompass filter is designed to estimate spacecraft roll and yaw angles. Improvement comes largely from the estimation of yaw gyro drift. For active attitude control bang-bang laws and saturation laws using linear feedback are compared. The latter can be implemented approximately by PWPF-modulators using on-off jets and avoiding chatter motion. Additional results about chatter motions in multi-input systems are included. Author (ESRO)

N71-29631*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION CONTROL DURING ENTRY INTO THE ATMOSPHERE
D. Ye. Okhotsimskiy et al 2 Feb. 1971 26 p refs Transl. into ENGLISH from Guidance and Control in Space; Intern. Federation of Autom. Control Congr., 4th, Warsaw, Poland, 16-21 Jun. 1969, Proc. (Poland), 1969 p 67-83
(AD-722305; FTD-MT-24-254-70) Avail: NTIS CSCL 22/2

Development of a motion control algorithm for a spacecraft reentering the atmosphere at a velocity on the order of the escape velocity. It is assumed that the spacecraft has a stabilized platform with three accelerometers positioned along mutually perpendicular axes, and that the motion control is realized by changes in the spacecraft lift direction produced by changes in the roll angle, while the required roll angle is obtained by onboard computer analysis of the measured data. Simulation results indicate that by a rational selection of the algorithm parameters this reentry trajectory control problem can be effectively solved and the algorithm can be made sufficiently insensitive to medium-density variations during reentry and landing. Author (GRA)

N71-29563*# European Space Research Organization, Paris (France).
PLANETARY SPACE MISSIONS. VOLUME 5: MERCURY AND SOLAR PROBES
Dec. 1970 49 p refs Partly in ENGLISH and partly in FRENCH
Proc. of the 7th ESRO Summer School, Interlaken, Switz., 1969
(ESRO-SP-57) Avail: NTIS

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2. EUROPEAN MERCURY FLY-BY MISSION PROJECT: INTERPLANETARY EXPERIMENTS K. Sitte (Freiburg Univ.) p 13-20 (See N71-29566 17-31)

3. EUROPEAN MERCURY FLY-BY MISSION PROJECT: SPACECRAFT DESIGN CRITERIA D. E. Koelle (Messerschmidt-Boelkow-Blohm G.m.b.H., Munich) p 21-37 refs (See N71-29565 17-31)

4. THE GERMAN SOLAR PROBE (HELIOS): DESIGN CRITERIA AND DEVELOPMENT PROBLEMS D. E. Koelle (Messerschmidt-Boelkow-Blohm G.m.b.H., Munich) p 39-42 (See N71-29564 17-31)

N71-29564*# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
THE GERMAN SOLAR PROBE (HELIOS): DESIGN CRITERIA AND DEVELOPMENT PROBLEMS
Dietrich E. Koelle *In* ESRO Planetary Space Missions. Vol. 5: Mercury and Solar Probes Dec. 1970 p 39-42 (See N71-29563 17-31)
Avail: NTIS

The purpose of the Helios spacecraft is to explore the interplanetary space between 1.0 and 0.3 a.u., but not to explore the Sun itself. The report of the joint US/German Mission Definition group was completed in March 1969. Owing to the preponderance of cosmic ray and magnetic field experiments in the fourteen to be carried, spin stabilization was decided upon. The problems of efficiency of the solar cell array with increasing temperature demanded special measures which led to three possible concepts for the spacecraft configuration, of which the double-cylinder design, was adopted. For the telecommunications system, a despun high-gain antenna was required. Development on Helios is expected to start early in 1970; two launchings are planned for 1974 and 1975. Author (ESRO)

N71-29565*# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EUROPEAN MERCURY FLY-BY MISSION PROJECT: SPACECRAFT DESIGN CRITERIA
Dietrich E. Koelle *In* ESRO Planetary Space Missions. Vol. 5: Mercury and Solar Probes Dec. 1970 p 21-37 refs (See N71-29563 17-31)
Avail: NTIS

The three types of mission profile, aphelion, nodal, and intermediate transfers, are compared and particulars are given for all three for launchings in 1974 and 1975. Technical problems in the design of a Mercury probe as regards the TV system, power supply, and thermal control are mentioned. Three different configurations, of which two are unoriented and the other has a dual-spin approach, are briefly described. Each is designed for a payload of four planetary and five interplanetary experiments. An extensive bibliography relating to Mercury missions is included.
Author (ESRO)

N71-29566# Freiburg Univ. (West Germany).
EUROPEAN MERCURY FLY-BY MISSION PROJECT: INTERPLANETARY EXPERIMENTS
K. Sitte *In* ESRO Planetary Space Missions. Vol. 5: Mercury and Solar Probes Dec. 1970 p 13–20 (See N71-29563 17-31)
Avail: NTIS

The proposals for the five interplanetary experiments to be carried in the European Mercury probe are dealt with. The experiments were selected on the basis of those which would gain most from such a mission; where the results of one experiment would be enhanced by other observations, complementary experiments were included. Three such interrelated experiments (measurements of interplanetary magnetic field, energy distribution of the solar plasma, and intensity of energetic particle radiation) are proposed and discussed at some length; it is shown how the different needs of the three experimenters involved can be met. A separate experiment to investigate the plasma composition is proposed. The last choice is a micrometeorite experiment to provide information on the size distribution and nature of the dust particle. Finally some tentative ideas are presented on how equipment intended for planetary studies could also be used during the interplanetary journey. Author (ESRO)

N71-29567# European Space Research Organization, Paris (France).
STUDY OF A FLYBY MISSION TO MERCURY PLANET: ONBOARD EXPERIMENTS FOR THE STUDY OF THE PLANET [ETUDE D'UNE MISSION DE SURVOL DE LA PLANETE MERCURE: EXPERIENCES EMBARQUEES DESTINEES A L'ETUDE DE LA PLANETE]
J. Collet *In its* Planetary Space Missions. Vol. 5: Mercury and Solar Probes Dec. 1970 p 1–12 In FRENCH (See N71-29563 17-31)
Avail: NTIS

Main known data on Mercury planet are introduced. An ESRO project for a flyby mission investigating the Mercury atmosphere, the planetary surface structure, temperature, and topography is reviewed. Emphasis is made on space probe onboard instrumentation which will either be a television camera, a polarimeter, photometer, a microwave receiver, or an infrared radiometer. ESRO

N71-29629# Sandia Corp., Albuquerque, N.Mex. Reentry and Space Sciences Div.
THEORETICAL EXPLANATION OF A VERTICAL FLIGHT FREE-FALL BALLISTIC CHART
G. W. Stone Dec. 1970 14 p Sponsored by AEC
(SC-RR-70-881) Avail: NTIS

A theoretical analysis of the translational motion of objects dropped from rest at altitude is performed to explain the inherent characteristics of a ballistic chart that was developed by empirical means. Author (NSA)

N71-29710*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL STABILITY CHARACTERISTICS OF PRELIMINARY CONFIGURATIONS FOR SCOUT D AT MACH NUMBERS 0.20 TO 4.63
Robert J. Keynton Washington May 1971 132 p
(NASA-TN-D-6239) Avail: NTIS CSCL 22B

Results were obtained in the Langley 8-foot transonic pressure tunnel and the Langley Unitary Plan wind tunnel at Mach numbers from 0.20 to 4.63 for several variations of a 1/15-scale model of the Scout D launch vehicle and with two heat-shield configurations. The investigation extended over an angle-of-attack range of + or − 10 deg and selected roll angles from 0 deg to 180 deg. The Reynolds number was 13,100,000 per meter for the 8-foot transonic pressure tunnel and 9,800,000 per meter for the Unitary Plan wind tunnel (except at Mach numbers 0.20 and 0.40, which had Reynolds numbers of 6,600,000 and 9,800,000 respectively). With the currently estimated center-of-gravity Mach number history, both heat-shield configurations were statically unstable through portions of the supersonic Mach number region. The effect of protuberances (wiring tunnels, antennas, etc.) on the center of pressure was negligible with the exception of the wiring tunnels, which produced a small change in static margin. Author

N71-30037# Centre National d'Etudes Spatiales, Paris (France).
EUROPA LAUNCHER: SECOND STAGE CORALIE [LANCEUR EUROPA: DEUXIEME ETAGE CORALIE]
C. Chassignet, A. Grimaud, and Mahier-Yven (Soc. Tech. d'Etudes et de Rech. et d'Operations) Dec. 1970 133 p In FRENCH Sponsored by ELDO
Avail: NTIS

CORALIE is a liquid bipropellant stage with tanks pressurized by means of a gas generator. Pitch, yaw, and roll are controlled by thrust chamber swivelling in response to attitude data from the guidance computer mounted in the third stage. The flight sequence is commanded by a system of two sequencers acting in parallel on pyrotechnic circuits. The stage also comprises a telemetry system for transmitting flight data, a radar tracking system, and a safety telecommand system (destruction). Associated with the stage is a checkout and control system, one unit being located at the manufacturer's and two units at the Guiana range.
Author (ESRO)

N71-30043# European Space Operations Center, Darmstadt (West Germany).
DRAG AND LIFT PERTURBATIONS OF THE ORBIT OF THE TD-1 SATELLITE
F. Hechler and M. C. Eckstein Paris ESRO Nov. 1970 28 p refs
(ESRO-SR-14) Avail: NTIS

It is shown how analytic expressions can be derived for the perturbations due to air resistance acting on the special configuration of the TD-1 satellite in its nearly-circular orbit and its particular attitude. The density is represented by polynomials and trigonometric series which are constructed by interpolation of the CIRA tables. A simple form of the time dependence of the density due to solar flux is assumed. The drag and lift forces are calculated on the assumption that the mode of transfer of momentum is composed of specular reflexion, complete accommodation, and diffuse reflexion of the impacting molecules. The simple drag formula turns out to be a special case of this more sophisticated model. Some of the tedious algebraic manipulations are performed with the aid of FORMAC. Author (ESRO)

N71-30103*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WIND BIASING TECHNIQUES FOR USE IN OBTAINING LOAD RELIEF
Gale Ernsberger 14 Jun. 1971 38 p refs
(NASA-TM-X-64604) Avail: NTIS CSCL 22B

The merits of biasing to various statistical wind models are discussed with emphasis placed on the monthly mean vector wind. Substantial load relief is demonstrated for the AAP-1 Skylab launch vehicle by biasing in both pitch and yaw. The advantages

of hybrid computer simulations with Jimsphere wind profile inputs are discussed. Comparisons between launch delay risk using the synthetic wind approach and the Jimsphere detailed wind show that the detail wind gives a more realistic approach and a lower launch delay risk. Author

N71-30111# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COUNTLESS USES OF SATELLITES
M. Rebrov 28 Dec. 1970 106 p Transl. into ENGLISH of the book "Tysyacha Professiy Sputnika", USSR, 1969 p 5–102
(AD-722817; FTD-HC-23-616-70) Avail: NTIS CSCL 22/2

Artificial earth satellites are opening the way to interplanetary travel and our contemporaries evidently will be witnesses of how the free and conscientious work of the people of the new, socialist society is turning the boldest dreams of mankind into a reality. So ended the TASS report on launching the world's first artificial earth satellite. Every new launching, each new 'step' toward the stars, convinces us of the correctness of these lines. In our day ships and satellites are flying into space which are incomparably more complex and better equipped than their predecessors, the pioneers of the space era. This book discusses the use of satellites, the various tasks of the 'space workers', what they are today and what they will become in the future. The author discusses the applied use of space, a fascinating discussion probably because of the grandoise nature of the theme itself. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-29421# Naval Weapons Center, China Lake, Calif.
A MATHEMATICAL MODEL FOR PREDICTING THE DAMPING TIME OF A MERCURY DAMPER
Ernest E. Rogers Feb. 1971 17 p
(AD-722003; NWC-TP-5092) Avail: NTIS CSCL 20/11

The mercury damper is a device for damping the nutation of a rotating body. This report explains how a mercury damper works, and derives a simple expression for the damping time. Author (GRA)

N71-29488# Technische Hogeschool, Delft (Netherlands). Vliegtuigbouwkunde.
THE INTERACTION OF LOCAL BUCKLING AND COLUMN FAILURE OF IMPERFECT THIN-WALLED COMPRESSION MEMBERS
J. J. Meijer and A. van der Neut Apr. 1970 33 p refs
(VTH-160) Avail: NTIS

Asymmetry is introduced in the cross section of a thin-walled column by unequal imperfections of its two flanges. Numerical evaluation shows that (1) the buckling load can be smaller than the local buckling load as well as the Euler load, (2) the equilibrium at the bifurcation point can be unstable, inducing explosion collapse, and (3) the instability is more severe with small imperfections. Tests confirm the analytical findings. ESRO

N71-29532# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSVERSE IMPACT OF A BLUNT AXISYMMETRIC BODY OF ARBITRARY SHAPE AGAINST A FLEXIBLE PLATE
U. Bektursunov 22 Jan. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR, Ser. Fiz-Mat. (Kazakh SSR), v. 5, no. 1, 1967 p 33–37
(AD-722281; FTD-HC-23-873-70) Avail: NTIS CSCL 19/4

The problem of transverse impact against an unbounded flexible plate is the topic of a number of papers. In all these research papers it is assumed that the high tensile impact-wave velocity does not exceed the longitudinal wave velocity. Consequently, under this assumption, after impact two regions occur: the region of purely longitudinal motion and the region of transverse motion. This picture of the motion is characteristic of impact by a pointed body. The paper contains an investigation of impact of a blunt body against a flexible plate for which the high tensile impact wave velocity exceeds the speed of sound in the material. GRA

N71-29541# California Univ., Berkeley. Coll. of Engineering.
CREEP-RUPTURE UNDER MULTIAXIAL STRESS Final Report, 6 Oct. 1969–31 Jul. 1970
M. M. Abo El Ata and I. Finnie 102 p refs Sponsored in part by AEC
(UCRL-13489) Avail: NTIS

The creep-rupture of metals with particular reference to multiaxial stress is reviewed. It is shown that none of the methods that have been proposed for using uniaxial test data to predict the life of components under multiaxial stress are entirely satisfactory. By considering creep-rupture to be a two stage process of crack initiation and subsequent crack growth another approach to life-prediction which is more general than existing methods is developed. The subject of creep-damage under stresses and temperatures which may vary with time is also reviewed. Again, by making use of the two stage concept of creep-rupture it is possible to develop a damage rule which appears to be superior to existing methods. An important practical problem is creep-rupture in the presence of a notch. No entirely satisfactory solution to this problem is yet available, but an extensive review of the literature including suggested design approaches is presented. Author

N71-29644# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLEXIBLE PLATES AND PANELS
M. S. Kornishin et al 21 Jan. 1971 297 p refs Transl. into ENGLISH of the book "Gibkie Plastiny i Paneli" USSR, 1968 p 1–260
(AD-722302; FTD-HC-23-441-69) Avail: NTIS CSCL 20/11

The book contains results of solutions of geometrically nonlinear problems related to transverse bending of both circular and rectangular plates and flat panels sustaining different loads under various boundary conditions. Basic relationships are cited. The data are provided in tables showing dimensionless loading parameters with respective dimensionless deflections and stresses. Tabular data makes it possible to establish design parameters without complex calculations. Author (GRA)

N71-29646 Wisconsin Univ., Madison.
A STATISTICAL ANALYSIS OF THE FATIGUE LIFE OF AN ALUMINUM ALLOY UNDER WIDE BAND RANDOM LOADING
Robert Walter Lanz (Ph.D. Thesis) 1969 93 p
Avail: Univ. Microfilms Order No. 70-3800

The response of a linear spring-mass-damper system subjected to a wide band random force input of constant spectral density, in conjunction with the fatigue life of a 60-61 T651 aluminum specimen which acts as the spring in the system is studied. The response of the system, measured with a load cell in series with the spring, and recorded on magnetic tape, was digitized with a hybrid computer. Statistical tests applied to the digitized information showed the response of the system to be normal. The fatigue life of the specimen is correlated to three significant system response

parameters. By keeping one of these parameters constant, correlations between fatigue life and the other two parameters are found by statistical tests. Dissert. Abstr.

N71-29646 Michigan Univ., Ann Arbor.
DYNAMIC SNAP-THROUGH STABILITY OF THE NONLINEAR, ELASTIC, PLANE STRAIN, FREE VIBRATION OF A SHALLOW CYLINDRICAL SHELL
Lee James Ovenshire (Ph.D. Thesis) 1969 154 p
Avail: Univ. Microfilms Order No. 70-14611

The dynamic snap-through stability of the nonlinear, elastic, plane strain, free vibration of a shallow circular cylindrical shell is studied using equations of motion based upon thin-shell theory. Critical configurations, are derived for general linear elastic bending restraints against rotation at the boundaries. The strain potential energy for configurations with no bending restraints is presented. Based on the energy of the critical configurations a stability sufficiency condition is determined. If the total energy of the shell never exceeds a certain level, the shell cannot snap through. It is found that stability sufficiency conditions based upon thin-shell theory and shallow-beam theory are qualitatively the same. Dissert. Abstr.

N71-29751 Virginia Polytechnic Inst., Blacksburg.
FRACTURE ANALYSIS OF AN AXI-SYMMETRICAL SOLID
Ivan Dah-Wu Chow (Ph.D. Thesis) 1970 191 p
Avail: Univ. Microfilms Order No. 70-13683

The finite element method of analysis is applied to the axially symmetric solid, and is extended to fracture analysis. The numerical analysis may be broken into three parts. The first involves the role of linear elasticity, the second deals with the elastic-plastic deformations, and the third is concerned with the interaction between such deformation and the fracture process. For the finite solid element method, the crack is thought to initiate below the surface of a notch, approximately in the region of highest triaxiality of the stress under the ultimate load, rather than at the root of the notch. For the lattice analogy method, the fracture is assumed to progress as each critically stressed member reaches its ultimate and is deleted from the remaining assembly. Both the finite solid element method and the lattice analogy method are used to analyze numerically the solid and hollow notched tensile specimens with the ultimate load held constant during fracture. Dissert. Abstr.

N71-29762 Michigan Univ., Ann Arbor.
DEFLECTION ANALYSIS OF A HEATED THERMORHEOLOGICALLY SIMPLE VISCOELASTIC DISK
Charles Kenneth Felber (Ph.D. Thesis) 1969 106 p
Avail: Univ. Microfilms Order No. 70-14512

The displacements of a thin, viscoelastic disk subjected to mechanical and thermal loading are investigated. An important feature of the analysis is the inclusion of the temperature dependence of the viscoelastic modulus and other material properties. The class of materials considered is called thermorheologically simple. The effect of temperature on this material is to shift the time scale of the viscoelastic properties so that the material deforms more rapidly at elevated temperature. Variation in the amount of this time shift for different temperatures is described by introducing a new material parameter, the shift function. Equations of equilibrium are derived in terms of the stress moments and resultants of plate theory. After simplifying assumptions are made, these equations are uncoupled and linearized and a solution is obtained using numerical methods on a digital computer. Dissert. Abstr.

N71-29767# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
AN EXPERIMENTAL STUDY OF WIND FORCES OF OFFSHORE STRUCTURES
John H. Nath Aug. 1970 104 p refs
(Grant NSF GK-4679)
(PB-198037; CER70-71JHN3) Avail: NTIS CSCL 13M

The experimental study verified that the pressure coefficients and the total drag coefficient are reduced for a structure when it is elevated on supports. The jet of air under the structure reduces the magnitudes of both the positive pressures on the upstream face of the building and the negative pressures on the downstream face. In addition, it is indicated that for offshore structures and other elevated ocean structures that the drag coefficient increases drastically on the windward face of a wave. Author (GRA)

N71-29768# West Virginia Univ., Morgantown. Dept. of Civil Engineering.
THE NUMERICAL STUDY OF FREE VIBRATION FOR GRILLAGES Civil Engineering Studies Report
Fu-Shan Cheng and Hota V. S. GangaRao 1971 103 p refs
(PB-197512; CES-2012) Avail: NTIS CSCL 20K

The report describes a numerical study of the grid solutions presented by Ugarte and Dean, considering the torsional effects and those presented by GangaRao and Smith, neglecting the torsional effects. From this numerical study, the significane of torsional effects in obtaining the natural frequencies of grids will be determined. Another object of this report is to assess the accuracy of natural frequencies of grids, considering distributed-mass system versus the lumped-mass system. A numerical study on the grid effectiveness of diaphrams in stringer bridges will also be made to determine the number and general size of diaphrams required for economical design purposes. Author (GRA)

N71-29781# Watervliet Arsenal, N.Y.
HIGH FREQUENCY CHORDWISE BENDING VIBRATIONS OF RECTANGULAR PLATES
Wayne W. Walter and Gary L. Anderson Mar. 1971 54 p refs
(AD-722729; WVT-7114) Avail: NTIS CSCL 20/11

Based upon Mindlins theory of flexure of isotropic elastic plates, an approximate theory of flexure for the class of problems associated with rectangular plates that are clamped on one edge and free on the opposite edge is developed. It is assumed that the loads on the faces of the plate vary slowly with the spanwise coordinate and vary arbitrarily with the chordwise coordinate. Certain Timoshenko beam modes and a thickness-twist mode are used to approximate the spanwise behavior of the displacements of the plate, whereas the chordwise components of the displacements are permitted to vary freely in the application of Hamiltons principle. Using the Kantorovich method and Yus generalization of Hamiltons principle, the approximate partial differential equations of motion and the associated boundary conditions are derived. The problem of determining the dispersion relation for straight-crested waves propagating along an infinite cantilevered plate strip is solved, and numerical results are obtained. The numerical values obtained herein are compared with other approximate and exact results developed in previous studies. Author (GRA)

N71-29803 Michigan Univ., Ann Arbor.
THE DYNAMIC RESPONSE OF A SOLID ELASTIC CYLINDER BONDED TO A THIN SHELL
John J. Ruminer (Ph.D. Thesis) 1969 97 p
Avail: Univ. Microfilms Order No. 70-14627

The dynamic interaction of a solid elastic circular cylinder which is bonded to a thin shell of a different material is discussed. The analysis employs linear theory and is restricted to plane strain. The exact dynamical equations of elasticity govern the core. The small deflection thin shell theory, including both membrane and bending effects, governs the shell. The two sets of equations are coupled by the requirement of continuity of surface tractions and displacements at the interface. The free motion of the composite structure is discussed. The characteristic equation is derived and the effect of various shell-core parameters on the natural frequencies

is determined. An orthogonality relationship is derived for the corresponding set of eigenfunctions, and the solution to an initial value problem is expressed as a superposition of these functions. Numerical results are presented for the particular case of nonaxisymmetric static loading which is removed at time equal zero. Dissert. Abstr.

N71-29804 Illinois Univ., Urbana.
PARAMETRIC RESPONSE OF NONLINEAR ORTHOTROPIC PLATES
Willie James Carter (Ph.D. Thesis) 1970 73 p
Avail: Univ. Microfilms Order No. 70-13267

The amplitude and the build-up of amplitude are investigated for an orthotropic elastic plate, subjected to an oscillatory in-plane load. The resulting nonlinear partial differential equations are solved using a modified Galerkin technique. Numerical solutions indicate that the excitation parameter has a significant effect upon the resulting amplitudes. The effect of transverse shear on the boundary frequencies is also investigated. The results indicate that transverse shear has a marked influence upon the boundary of the instability regions. Dissert. Abstr.

N71-29838 Drexel Univ., Philadelphia, Pa.
EXPERIMENTAL AND THEORETICAL STUDY OF CYLINDRICAL STRESS WAVES
Joseph Lawrence Rose (Ph.D. Thesis) 1970 130 p
Avail: Univ. Microfilms Order No. 70-13204

An experimental technique that uses exploding wires to generate cylindrical stress waves in long, hollow, thick-walled shells has been developed. Photographs of several photoelastic test specimens have shown that the wave front is axially symmetric. The wave speeds measured from the photographs are in close agreement with the theoretical values of the dilatational velocity for cylindrical waves and the plate velocity for waves in thin plates. It is also shown that the experiment is suitable for studying dynamic material constitutive equations. In addition, a computer code utilizing the method of characteristics has been developed to analyze experimental data. This computer code was also used in this work to generate design curves that are useful for quickly determining frequency characteristics of thick-walled spherical and cylindrical shells. Dissert. Abstr.

N71-30041# Technische Hogeschool, Delft (Netherlands). Vliegtuigbouwkunde.
DETERMINATION OF THE INITIAL BUCKLING STRESS OF FLAT PLATES USING THE DISPLACEMENT METHOD [BEPALING VAN DE INITIELE KNIKLAST VAN VLAKKE PLATEN MET BEHULP VAN DE VERPLAATSINGSMETHODE]
T. J. Van Baten and F. A. M. Molhoek Dec. 1969 54 p refs In DUTCH; ENGLISH summary
(VTH-161) Avail: NTIS

The problem of computing the buckling stress of structures composed of flat plates, applying the finite element method or displacement method, is dealt with. The given method is evaluated for flat rectangular plates under arbitrary inplane loads; rectangular plate-bending elements with 12 and 16 degrees of freedom are used. The results of a number of computations are compared among themselves and with values given in literature. Author (ESRO)

N71-30044# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
STRENGTH VARIABILITY IN STRUCTURAL MATERIALS
F. Clifton London Aeron. Res. Council 1971 24 p refs Supersedes RAE-TR-69015; ARC-31416
(ARC-R/M-3654; RAE-TR-69015; ARC-31416) Copyright. Avail: NTIS; HMSO: 60p; BIS: $2.40

Strength variability in structural materials is discussed in its relation to the assessment of safe stresses for use in design, and to the loads to be prescribed for the approval of a structural design by test. The structural penalty imposed by the latter method of approval is examined and means of reducing severity are discussed. A list is given of variability values (coefficients of variation) obtained from tests on a wide variety of aeronautical structural materials, fastenings, and components. Author (ESRO)

N71-30062*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF SUBSYSTEMS IN LARGE STRUCTURES
T. K. Caughey 30 Jun. 1971 29 p ref
(Contract NAS7-100)
(NASA-CR-118986; JPL-TM-33-484) Avail: NTIS CSCL 13M

A qualitative mathematical analysis was made of various approximate schemes which have been suggested in an attempt to short cut the long and expensive computations which are required in the design of subsystems in large, complex structures. It is shown that the simple scheme of using the known blocked response of the main structure as the input to the subsystem does not, in general, lead to a convergent iterative process. The theory of the vibration absorber is used to illustrate this point. A scheme which uses the response of a known system as the input to a new system, which differs only slightly from the known system, is shown to result in a convergent iterative process. It is shown that the first iterate of this process is sufficiently accurate for preliminary design purposes. Author

N71-30066 Pennsylvania State Univ., University Park.
INERTIAL EFFECTS IN IMPULSIVE PLASTIC EXPANSION
Bhagwati Prasad Gupta (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-13829

The finite element method of analysis is used for the investigation of the problem of spherical and cylindrical cavity expansion due to inertia. The nature of the cavity motion with time, the final cavity size, and the total expansion time are determined. The material is assumed to follow rigid-plastic or rigid-viscoplastic behavior. The analysis is extended to laminated spheres and cylinders. This method is applied to a penetration problem at high velocity, whose dynamics is closely related to the cavity problem. In all the cases considered, the expansion of the cavity is faster and greater than that of the outer surface. The results for expansion of a sphere, subjected to a contained gas pressure pulse, are compared with those obtained experimentally and by a wave method, while the material (aluminum) is assumed to have arbitrary values of strain hardening. So far, the final cavity size and total expansion time could not be determined. The analysis of a cylindrical cavity is applied to a penetration model. Dissert. Abstr.

N71-30067 Illinois Univ., Urbana.
FLOW CRITERIA AND CONSTITUTIVE RELATIONS FOR THE NUMERICAL ANALYSIS OF PLANE STRESS PROBLEMS WITH CREEP
Thomas Wesley Pickel, Jr. (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms Order No. 70-13444

Four topics associated with the numerical analysis of plane stress problems with creep are considered. The first topic concerns the creep relationship to be used in predicting creep strains. Four relationships are considered, and these are compared with data obtained from constant-load, constant-temperature, tension tests on free-cutting brass and SAE 1035 steel specimens. The second concerns the effect of load and temperature histories on creep strains. The strains are predicted using the creep relationship with both strain-hardening and time-hardening hypotheses. The third topic concerns the flow criterion to be used in multiaxial stress problems. The fourth concerns the numerical approximations used in solving the multiaxial stress problem with creep. Dissert. Abstr.

N71-30118*# Florida Technological Univ., Orlando. College of Engineering.
MINIMUM WEIGHT DESIGN OF AXIALLY COMPRESSED

RING AND STRINGER STIFFENED CYLINDRICAL SHELLS
David L. Block Washington NASA Jul. 1971 73 p refs
(Grant NGR-10-019-002; 722-02-10-05)
(NASA-CR-1766; FTU-5501) Avail: NTIS CSCL 20K

The investigation examines the panel and general instability of the stiffened shell configuration and from this determines desirable stiffener parameters and proportions. Classical buckling equations are used which retain important effects of the stiffeners. The study indicates that for both rings and stringers, T-section stiffeners are preferable, and that the stringers should have a stringer area to shell wall area of approximately 0.56 for stringers outside and 0.44 for stringers inside; and that the rings should have a ring area to shell wall area of approximately 0.07 for rings inside, stringers outside, and 0.12 for rings inside, stringers outside. Using the desirable stringer and ring parameters, a method for obtaining the final design of the stiffener proportions and the shell thickness is presented by applying the equations governing the shell failure and instability modes. Results of calculations are presented illustrating the design of a stiffened cylinder under an axial compression loading and which show the critical parameters in such a design. Author

N71-30154 Pennsylvania State Univ., University Park.
RADIAL INERTIA EFFECTS IN DYNAMIC PLASTIC DEFORMATIONS
Govindappa Puttaiah (Ph.D. Thesis) 1969 99 p
Avail: Univ. Microfilms Order No. 70-13873

Analysis of dynamic plastic deformations in which radial inertia effects are included is presented. The deformations considered are such as those occurring in impulsive compression of a plate between two blocks and impact of projectiles. The present method differs from static analysis in that it gives time deformation and time stress history of the body during the loading process. The specific examples considered are: impulsive axial compression of a circular plate with boundary conditions on axial velocity or axial strain rates; impulsive axial compression of a circular plate with boundary conditions on axial force, pressure, energy or power; and impact of a finite cylindrical projectile on a rigid target. Dissert. Abstr.

N71-30155 Carnegie-Mellon Univ., Pittsburgh, Pa.
DEFORMATION CRITERIA IN THE COLD EXTRUSION OF METALS
Lawrance Joseph Kashar (Ph.D. Thesis) 1969 157 p
Avail: Univ. Microfilms Order No. 70-14177

By means of an energy balance an equation for calculating the extrusion pressure from material parameters was derived. To test the validity of the equation, compression and backward-extrusion tests were performed on pure lead, aluminum, copper, pure iron, an iron-manganese alloy, and six steels over a range of extrusion ratios (1.28 to 2.72) and extrusion speeds (0.005 to 1020 inches/minute). By using the extrusion equation, the extrusion pressures were predicted very accurately for all materials. However, the strain factors used in predicting the pressures were found to vary with extrusion speed. The effect of extrusion speed on the cold-forging pressures of the irons and steels was complicated by heating effects at speeds above 2 in./min. The results confirm the validity of the equation in the extrusion ratio-extrusion speed range investigated and establish the criterion that deformation energy, taken as the area under the true stress-true strain curve, determines the extrusion pressure. Dissert. Abstr.

N71-30156 Michigan Univ., Ann Arbor.
NUMERICAL APPROACH TO LARGE ELASTIC DEFORMATIONS OF AXISYMMETRIC MEMBRANE PROBLEMS
Kuo-Hsiung Hsu (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms Order No. 70-14548

A general approach to numerical solutions for axially symmetric membrane problems was considered. The formulation of the problem leads to three simultaneous differential equations in the normal form which is convenient for standard numerical methods. These equations are formulated such that the numerical integration can be carried out for any form of strain-energy function. Solutions to these differential equations are feasible for various boundary conditions. The Runge–Kutta method is employed to solve the system of differential equations, in which Mooney's form of strain-energy function is adopted. Some boundary conditions are satisfied by trial and error method. The effect of the parameter alpha = C2/C, in Mooney's strain-energy function on the deformation is discussed. At a high degree of inflation, an instability phenomenon is observed when alpha is less than a certain value. Dissert. Abstr.

N71-30157 Washington Univ., Seattle.
AN EXAMINATION OF AN ELASTIC/VISCOPLASTIC THEORY USING RADIAL CYLINDRICAL STRESS WAVE PROPAGATION
Robert Paul Swift (Ph.D. Thesis) 1969 133 p
Avail: Univ. Microfilms Order No. 70-14792

An experimental and analytical investigation of the dynamic plastic behavior of hollow cylinders, subjected to internal axisymmetric radial loadings by an exploding wire technique was used to ascertain the relative merits of an elastic/viscoplastic constitutive theory. Two forms of the viscoplastic part of the constitutive law are considered; a linear form and an exponential form. Two distinct types of experiments are employed; a finite-rise pressure pulse form of loading to examine the plane strain response of the cylinder, and a higher stress level impact test to view the decay behavior of a cylindrical elastic precursor. An analytic comparison of these tests is obtained from the numerical solutions of the associated initial boundary value problems for the linear and exponential models. The results for 1100-0 aluminum show that only the elastic/viscoplastic model, in which the plastic strain rate component is based on the dislocation concept of thermally activated intersection, can satisfy the requirements of both sets of tests. Dissert. Abstr.

N71-30220# California Univ., Berkeley. Div. of Applied Mechanics.
THE THEORY OF SHELLS AND PLATES. PART 1: KINEMATICS AND BASIC PRINCIPLES
P. M. Naghdi Jan. 1971 248 p refs
(Contract N00014-69-A-0200-1008)
(AD-722350; AM-71-1-Pt-1) Avail: NTIS CSCL 20/11

The report, the first of two parts, deals chiefly with kinematics and general principles for shells, both by direct approach (i.e., via the theory of a Cosserat surface) and from the three-dimensional equations of the classical continuum mechanics. Chapter B contains a general development of kinematics of shells and shell-like bodies while Chapter C is concerned with conservation laws, local field equations and thermodynamical aspects of the subject. Although all developments are carried out in the context of the nonlinear theory, various results appropriate to the linearized theory are also discussed. Author (GRA)

N71-30221# California Univ., Berkeley. Div. of Applied Mechanics.
THE THEORY OF SHELLS AND PLATES. PART 2: NONLINEAR THEORIES OF ELASTIC SHELLS
P. M. Naghdi Jan. 1971 242 p refs
(Contract N00014-69-A-0200-1008)
(AD-722351; AM-71-2-Pt-2) Avail: NTIS CSCL 20/11

The report, the second of two parts, deals with the nonlinear and the linear theories of elastic shells and plates. It represents continuation of Part I and again all developments are carried out both by direct approach (i.e., via the theory of an elastic surface) and from the three-dimensional equations. Chapter D contains derivations of constitutive equations, thermodynamical restrictions,

material symmetries and related results for both the nonlinear and the linear theories of elastic shells and plates. The relationship and correspondence between the results derived from the three-dimensional theory and those obtained by direct approach is discussed and special attention is given to the determination of the constitutive coefficients of the linear theory by direct approach in Chapter E. Author (GRA)

N71-30232*# Texas A&M Univ., College Station. Space Technology Div.
HYPERVELOCITY IMPACT EFFECTS Semiannual Progress Report
J. L. Rand 16 Mar. 1971 21 p refs
(Grant NGR-44-001-106)
(NASA-CR-119189) Avail: NTIS CSCL 20K

The effects of target strength, with 1100-0 Al as target material, on the cratering process caused by impact of hypervelocity projectiles, were investigated. Results show the material has a yield strength sensitive to the rate of loading, and dynamic hardness values must be used to correlate crater dimensions. Measurement results are given in tabular form. Graphs are also included. E.H.W.

N71-30296# Southwest Research Inst., San Antonio, Tex.
AN IMPACT-ENERGY ATTENUATING DEVICE COMBINED WITH GUARDRAIL-LIKE STRUCTURES Final Report
W. E. Woolam Jan. 1970 104 p refs
(Contract FH-11-6863; SwRI Proj. 02-2372)
Avail: NTIS

An energy absorbing guardrail concept was designed to redirect an errant vehicle parallel to the normal traffic flow with a minimum of damage to the vehicle and, more important, to reduce the injuries to the passengers of the vehicle to a tolerable level. Energy absorption is accomplished utilizing an aerospace developed energy absorber – the fragmenting tube. In addition, a new design concept is introduced whereby a box beam type guardrail, cantilevered from backup posts, is allowed 2 ft of energy absorption prior to bottoming out against a backup system which could possibly be designed stiff enough to retain heavier vehicles such as buses and large trucks. The cantilevered design prevents damage from post snagging. Based on the results of four full-scale crash tests this conceptually new energy absorbing type bridge rail system shows definite promise when compared to the present rigid post concept. Author

N71-30302# National Bureau of Standards, Washington, D.C. Engineering Mechanics Section.
DETERMINATION OF DYNAMIC LOADS IN A HIGH FREQUENCY DIRECT STRESS FATIGUE MACHINE
Donald C. Robinson Jun. 1971 29 p refs
(NBS-TN-578) Avail: SOD $0.35

A refined test procedure is given for accurately recording the dynamic signals from instrumented test bars used to measure loads during simulated fatigue tests. Loads indicated by the load transducer of a direct-stress fatigue machine are compared with those determined from these instrumented test bar specimens which have been calibrated under static conditions. An application of this procedure is described for a resonant, electromagnetic, direct-stress fatigue machine having an optical dynamometer for indicating programmed loads. The variables investigated were the operating frequency, cyclic load and specimen stiffness. Author

N71-30303 + National Aerospace Lab., Amsterdam (Netherlands).
THE EFFECT OF LOAD SEQUENCE ON FATIGUE CRACK PROPAGATION UNDER RANDOM LOADING AND PROGRAM LOADING
J. Schijve, F. A. Jacobs, and P. J. Tromp 14 Jan. 1971 27 p refs
(NLR-TR-71014-U) Avail: NTIS

Crack propagation was studied in 2024-T3 Alclad sheet specimens under two types of random loading and under program loading with a short period and a long period. In the program tests Lo-Hi, Lo-Hi-Lo and Hi-Lo sequences were employed. Fractographic observations were made. Author

N71-30316# New South Wales Univ., Kensington (Australia). School of Civil Engineering.
IMPROVED MULTILOCAL FINITE-DIFFERENCE VARIANT FOR THE BENDING ANALYSIS OF ARBITRARY CYLINDRICAL SHELLS
A. K. Noor Mar. 1971 101 p refs
(UNICIV-R-63) Avail: NTIS

Several variants of the multilocal and ordinary finite difference schemes, with local discretization errors, were applied to the bending analysis of closed circular and noncircular cylindrical shells, with constant and variable rigidity. The study was based on the Sanders – Budiansky first approximation theory. Two variants of the mixed formulation in terms of stress resultants and displacements were used. The effects of variations in loading and shell geometry (curvature and thickness) on the accuracy and convergence of the different multilocal and ordinary finite difference variants are discussed. On the basis of the accuracy and convergence study of the various multilocal and ordinary finite difference schemes, an improved multilocal finite difference variant was developed which combined a number of advantages over both conventional multilocal and modified ordinary difference scheme presented in an earlier report. Author

N71-30317# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
DYNAMIC STRESS CONCENTRATION AT A CHAMFERED CHANGE OF SECTION
S. M. Steam Oct. 1970 16 p refs
(RD/B/N-1795) Avail: AEC Depository Libraries

The assumptions made in deriving the concentration of dynamic stress at a sharp change of section were investigated. It is concluded that the same analysis may be used to predict the dynamic stress concentration at a chamfered change of section, such as to be found on the gas baffle of Dungeness B. The result is verified by experiment. Author (NSA)

N71-30319# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING SOLID BEAMS OF FIBERGLASS REINFORCED PLASTICS
L. I. Kalenderyan et al. 29 Jan. 1971 16 p refs Transl. into ENGLISH from Nikolayev. Korablestroitelnyy Inst. Sudostr. i Morskiye Soorzheniya (USSR), no. 6, 1967 p 24–31
(AD-722309; FTD-HT-23-815-70) Avail: NTIS CSCL 13/13

The static design of solid beams of glass-reinforced plastics on independent elastic supports is examined. A static calculation method that takes into account the difference between the elastic moduli and the effect of shear is developed. The principal relations are given for the bending of beams of a material with different elastic moduli under linear tension and compression, and the differential bending equations are obtained. Angles of turn of the support sections of a single-span beam are determined. Multispan beams that rest freely on independent elastic supports are also calculated. The obtained relations and equations are extensions of those of classical structural mechanics. An example calculation is given. It is found that for beams with a given ratio, the presence of a material with two elastic moduli and shears has little effect on the bending moments. For beams with a given ratio, the effect of these factors increases, and they must be taken into account. Author (GRA)

N71-30334 National Lending Library for Science and Technology, Boston Spa (England).

STUDIES ON HIGH PRESSURE MULTI-LAYER CYLINDRICAL VESSELS. REPORT NO. 1: EXPERIMENTAL STUDY

Yoshi Akita et al Feb. 1971 31 p refs Transl. into ENGLISH from Ishikawajima-Harima Eng. Rev. (Japan), v. 7, no. 34, 1967

(NLL-RTS-5936) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.90; 10 NLL photocopy coupons

The design, construction, and inspection of multilayer cylindrical vessels for high pressure and large volume use are discussed as well as strength analysis theories. Optimum designs with high tensile steel outer layers and mild steel layers are are described. Trial production and destructive testing of 6-layer cylinders made of similar and dissimilar materials and 20-layer cylinders based on the optimum design are outlined. J.M.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-29246# Oak Ridge National Lab., Tenn.

THEORY OF A TIME DEPENDENT HEAT DIFFUSION DETERMINATION OF THERMAL DIFFUSIVITIES WITH A SINGLE TEMPERATURE MEASUREMENT

R. B. Perez, R. M. Carroll, and O. Sisman Feb. 1971 25 p refs

(Contract W-7405-eng-26)

(ORNL-4478) Avail: NTIS

A method to measure the thermal diffusivity of reactor suels during irradiation was developed, based on a time-dependent heat diffusion equation. With this technique the temperature was measured at only one point in the fuel specimen. This method had the advantage that it was not necessary to know the heat generation (a difficult evaluation during irradiation). The theory included realistic boundary conditions, applicable to actual experimental systems. The parameters were the time constants associated with the first two time modes in the temperature-vs-time curve resulting from a step change in heat input to the specimen. With the time constants and the necessary material properties and dimensions of the specimen and specimen holder, the thermal diffusivity of the specimen can be calculated. Author (NSA)

N71-29272*# Translation Consultants, Ltd., Arlington, Va.

INFRARED RADIATION VAPORIZATION OF A WATER DROP [ISPARENIYE VODNOY KAPLI POD DEYSTVIYEM INFRAKRASNOGO IZLUCHENIYA]

V. I. Bukatyy et al Washington NASA Jun. 1971 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 1, 1970 p 141-142

(Contract NASw-2038)

(NASA-TT-F-13640) Avail: NTIS CSCL 20M

The experimental verification of the applicability of an equation for describing water drop vaporization rates in a laser radiation field of different densities is discussed. Author

N71-29273*# Purdue Univ., Lafayette, Ind. Heat Transfer Lab.

AN EXPERIMENTAL AND ANALYTICAL STUDY OF REAL SURFACE EFFECTS ON RADIANT HEAT TRANSFER

J. S. Toor (Ph.D. Thesis), R. Viskanta, and E. R. F. Winter May 1971 162 p refs

(Contract NAS9-8118)

(NASA-CR-115065) Avail: NTIS CSCL 20M

The validity of the commonly used simplified models for predicting local as well as overall radiation interchange among real surfaces is examined. The directional and spectral effects have been examined separately by comparing the experimental data with the predictions based on simple and more detailed models for the radiation properties of surfaces. These comparisons have been made spectrally and on a total basis. Because of the mathematical difficulties associated with the numerical solution of a system of integral equations for the intensity of radiation leaving a surface, the problem has been solved by the Monte Carlo method. Solutions for the local incident flux were obtained for several models approximating the radiation characteristics of the surfaces. Author

N71-29274*# AiResearch Mfg. Co., Los Angeles, Calif.

RESEARCH STUDY ON INSTRUMENT UNIT THERMAL CONDITIONING PANEL Final Report

D. W. Graumann, C. E. Richard, J. D. Duncan, J. C. Gibson, C. S. Coe et al May 1971 239 p refs

(Contract NAS8-11291)

(NASA-CR-103190; Rept-71-7133) Avail: NTIS CSCL 20M

A heat pipe panel 30 in. by 30 in. was designed, fabricated, and tested to the design requirements of the Saturn 5 vehicle. Investigations into wick materials, preservation of wick materials, and porous plate sublimation was performed in conjunction with a study of noncondensable hydrogen gas generator in 304 stainless steel heat pipes with water as the working fluid. Author

N71-29452*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

DEVELOPMENT STATUS OF REUSABLE NONMETALLIC THERMAL PROTECTION

D. Greenshields, G. Strouhal, D. Tillian, and J. Pavlosky *In its* NASA Space Shuttle Technol. Conf., Vol. 2 Apr. 1971 p 1-38 (See N71-29451 17-17)

Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Both inhibited carbon-carbon systems and surface insulation systems have been under intensive development. A large number of materials have been developed and evaluated, and prime candidates chosen. Early property measurements and design studies indicate that systems satisfying all shuttle requirements can be developed with use of these materials, and that system weights will be lower than those for other system concepts for the same temperature ranges. As anticipated, problem areas in both systems are becoming evident as test data accumulate; however, directions for further development are evolving. It is concluded that current efforts will develop the technological base required for application of the nonmetallic materials to the shuttle thermal protection system. Author

N71-29507# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

STUDY OF THERMAL PHENOMENA IN A POROUS MEDIUM USING THE CHRISTIANSEN EFFECT [APPLICATION DE L'EFFET CHRISTIANSEN A L'ETUDE DES PHENOMENES THERMIQUES DANS LES MILIEUX POREUX]

Michel Cloupeau and Sorin Klarsfeld 1970 54 p refs In FRENCH Prepared jointly with Centre de Rech. Ind.

Avail: NTIS

Using the Christiansen effect an optical method has been developed for measuring local temperature in porous materials by visualizing isotherms of a twodimensional heat field. The bandpass filter is discussed for optimizing the results. ESRO

N71-29615*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

EFFECT OF ENVIRONMENT ON INSULATION MATERIALS

R. T. Parmley *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 4 Apr. 1971 p 1411-1437 (See N71-29609 17-28)

(Contract NAS3-14342)
Avail: NTIS CSCL 20M

Insulation materials were exposed to a series of atmospheric and orbital environments to determine the effects of environment on specific material properties as a function of exposure time, exposure temperature, or fluorine or oxygen partial pressure. Other simulated environments include exposure to ground contaminats, various operational temperatures, space vacuum, space-vented fuel, and tank leakage. Data from these exposures were evaluated to provide qualitative and quantitative analyses of physical and thermal property degradation of insulation materials. J.A.M.

N71-29616*# General Dynamics Corp., San Diego.
PPO FOAM INTERNAL INSULATION
G. B. Yates and R. E. Tatro *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol Conf., Vol. 4 28 Apr. 1971 p 1439–1452 (See N71-29609 17-28)
Avail: NTIS CSCL 20M

The various phases of the multiple mission cycle imposing new loads and thermal cycling requirements on the insulation materials were studied. Both external and internal insulation systems were used on existing space launch vehicles. An internal insulation concept was selected for the space shuttle vehicle. Installation inside the tank minimizes exposure of the material to potentially harmful external environments and keeps the tank skin and insulation bond line warm minimizing thermal stresses. Author

N71-29617*# Martin Marietta Corp., Denver, Colo.
INTERNAL INSULATION SYSTEMS FOR LH2 TANKS. GAS LAYER AND REINFORCED FOAM
H. H. Barker, Jr. (McDonnell-Douglas Astronaut. Co.), J. L. McGrew, D. L. Buskirk, John P. Gille, and J. M. Stuckey (NASA. Marshall Space Flight Center) *In* NASA. Marshall Space Flight Center Proc.: Space Transportation System Propulsion Technol. Conf., Vol. 4 28 Apr. 1971 p 1453–1480 (See N71-29609 17-28)
Avail: NTIS CSCL 20M

Two internal insulation systems which may meet the reusability, maximum temperature, and other requirements for the shuttle booster liquid hydrogen propellant tank insulation are briefly described. Post service experience, method of fabrication, thermal performance, and the contribution of glass thread reinforcement to strength properties of the current 3-D foam insulation are summarized. Progress made toward upgrading the reinforced foam insulation for shuttle use is outlined. The materials selection for the gas layer or capillary insulation, potentially usable on the shuttle, and another version intended for higher temperature service in a cryogenically fueled aircraft, are described. Tests proving the system feasibility, reusability, and low stressed characteristics (essentially free of pressure induced forces) are summarized. Author

N71-29669 Illinois Univ., Urbana.
EXPERIMENTAL STUDY OF MACH REFLECTION IN WEDGE-DRIVEN DETONATIONS
Rimantas Lieugminas (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms Order No. 70-13394

The Mach configuration resulting from the reflection of shocks and detonations from inclined surfaces was investigated using Schlieren and interferometry methods and smoke tracks. Use of a nozzle-ramp experimental arrangement permitted the optical observation of the flow and wave configuration behind an incident wave which simulates, in shape and decay characteristics, the type of wave encountered in the cells of self-sustaining detonations. The Mach number decay rate of the wave emerging from the nozzle was found to be between the rates characteristic to planar and cylindrical blast waves, while the orientation of the wave at the triple point at different positions in the test section was consistent with that of a cylindrical wave emanating from the nozzle throat. Mach number decay rates for reactive gases were higher than for non-reactive gases. Dissert. Abstr.

N71-29711*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUBCOOLED- AND NET-BOILING HEAT TRANSFER TO LOW-PRESSURE WATER IN ELECTRICALLY HEATED TUBES
James R. Stone Washington Jul. 1971 38 p refs
(NASA-TN-D-6402; E-6207) Avail: NTIS CSCL 20M

Experimental data are presented on subcooled and net-quality boiling heat transfer to water flowing vertically upward in tubes with uniform heat flux. Axial inner-wall-temperature distributions are tabulated for mass velocities from 0.67 to 141 kg/(sec)(sq m), heat fluxes from 43.8 to 11,400 kW/sq m, exit pressures from 24 to 690 kN/sq m abs, exit qualities up to 0.65, and liquid subcoolings as high as 151 K. Since no satisfactory correlations are available for the full range of test conditions, these experimental data over a wide range of test conditions should be useful to the designer. It appears that, for low-quality and subcooled boiling, nonequilibrium effects must be taken into account, and no presently available model appears to be valid over the full range of subcooling. Author

N71-29717# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
THERMAL CONDUCTIVITY AND SPECIFIC HEAT CAPACITY OF ZnS AND CdS IN THE TEMPERATURE REGION FROM 20 K TO 300K [WAERMELEITFAEHIGKEIT UND SPEZIFISCHE WAERMEKAPAZITAET VON ZnS UND CdS IM TEMPERATURBEREICH VON 20 K BIS 300 K]
Reinhard Krueger (Ph.D. Thesis) 1969 99 p refs In GERMAN
Avail: NTIS

An impulse method for measuring the time sequence of a temperature increase is reported that utilizes the thermal impulse triggered by absorption of a flash on the frontal surface of a cylindrical probe. Measured temperature increases give the thermal conductivity and specific heat capacity is determined from the optimal temperature increase. Heat conductivity measurements on single crystals of Zns and CdS established that their thermal resistance depends on differing lattice defects. Point defects affect thermal resistance above 100 K, angular deviations determine the increased thermal resistance reverse potential to the temperature below 100 K. The direction-bound but temperature independent part of thermal resistance is attributed to crystal lattice defects. Transl. by G.G.

N71-29718# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Fakultaet fuer Maschinenbau.
CONTRIBUTION TO THE TURBULENT HEAT TRANSFER IN A FOUR STROKE OTTO-CYCLE ENGINE [BEITRAG ZUM INSTATIONAEREN WAERMEUEBERGANG IN EINEM VIERTAKT-OTTOMOTOR]
Dietrich Grossmann (Ph.D. Thesis) 1969 114 p refs In GERMAN
Avail: NTIS

A forced turbulence flow model is formed for the nonsteady heat transfer in an Otto-cycle engine at the time when the combustion proceeds into the normal temperature boundary layer. A mixed layer flow describes the period when the flow transfers all free heat from the combustion process onto the wall, whereas for all other heat flow movements the heat transfer coefficients are obtained. Calculations using this model to determine turbulent heat transfer onto one point of the combustion chamber wall in an Otto-cycle engine of 0.5 stroke volume agreed with heat flow densities derived from measured stationary temperatures and pressures in the cylinder. Transl. by G.G.

N71-29734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXAMINATION OF BOUNDARY CONDITIONS FOR HEAT TRANSFER THROUGH A POROUS WALL
Raymond S. Colladay and Francis S. Stepka Washington Jul.

1971 24 p refs
(NASA-TN-D-6405; E-6237) Avail: NTIS CSCL 20M

An analytic model utilizing an experimental upstream wall heat transfer coefficient as a boundary condition is presented. An experiment was conducted to determine this coefficient for a surface simulating the surface of a typical full-coverage film-cooled turbine blade, and the results are presented. The temperature rises of the coolant approaching normal to the upstream surface and through a porous wall are more reasonable with the proposed model than with previous models. Author

N71-29801 Ohio State Univ., Columbus.
PHOTOCHEMICAL INITIATION OF COMBUSTION AND QUANTUM YIELDS IN FLOWING MIXTURES OF HYDROGEN, OXYGEN, AND CHLORINE
Lloyd Robert Lawrence, Jr. (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms Order No. 70-14064

Quantum yields and induction times have been measured experimentally in flowing mixtures of hydrogen, oxygen, and chlorine to determine the feasibility of photochemically initiated supersonic combustion. This research was carried out varying mixture, temperature, and intensity independently. Expressions having been derived to predict the induction times and quantum yields, using reaction rates based on the fundamental reaction mechanism. A thousand watt, mercury capillary lamp was employed as the light source, and a heated pyrex tube of 1.3 inch was used as the test section. The analysis techniques developed may be used to calculate the necessary induction times and light intensities to produce photochemical initiation of supersonic combustion. Dissert. Abstr.

N71-29807 Maryland Univ., College Park.
HYPERSONIC LAMINAR AND TURBULENT HEAT TRANSFER FOR SLIGHTLY BLUNTED SLENDER CONES
Willis Carson Lyons (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms Order No. 70-12929

An energy-integral method was developed for predicting pertinent characteristics of the thermal boundary layer on a slightly blunted, slender cone. The effect of nose bluntness was included by considering the flow at the outer edge of the boundary layer as nonisentropic flow. Relations are developed for both the laminar and turbulent cases, between the local Stanton number and the local Reynolds number based on the total enthalpy thickness. These relations were used in the solution of the energy-integral equation. This development was carried out for both the laminar and turbulent cases and for compressible flow with heat transfer. Using the developed equations, a digital computer program was prepared and coded in FORTRAN 4. It is shown that for both a laminar and a turbulent boundary layer the local Stanton number is reduced due to the effect of nose blunting and that, if a modified Reynolds analogy is assumed valid, the Reynolds analogy factor is less than the Prandtl number to the two-thirds power for a blunted cone. Dissert. Abstr.

N71-29820# Rocketdyne, Canoga Park, Calif.
PROPELLANT SPRAY COMBUSTION PROCESSES DURING STABLE AND UNSTABLE LIQUID ROCKET COMBUSTION Final Report, Jul. 1966 - Nov. 1970
R. D. Sutton Oct. 1970 377 p refs
(Contract AF 49(638)-1705)
(AD-722473; R-8377-1; AFOSR-70-2714TR) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/8

The purpose of this program is the acquisition of detailed analytical and experimental information concerning the mechanisms of energy addition from propellant spray combustion to steady flow fields and propagating pressure disturbances. Data are to be obtained and used to evaluate present or formulate new expressions describing the dynamics that contribute to the coupling processes between the spray and gas flow fields. These expressions appear in steady-state and transient propellant combustion models and bear directly on the prediction of performance and onset of high frequency combustion instability in liquid propellant rocket engines. To overcome past difficulties in comparing analytical and experimental results, an experimental apparatus which produces a monodisperse propellant spray uniformly distributed throughout the combustor has been built. The motor, to be operated as a rocket engine combustor under either stable or transient conditions, provides for optical observation and is extensively instrumented to record pressure wave amplification or decay as a function of parameter variation. Test data (drop diameters, velocity and pressure wave growth or decay as functions of chamber length and initial conditions) can be input to the newly-developed combustion models and the validity of the coupling term expressions evaluated by directly comparing the resulting predictions to experimental data. These newly-developed combustion models are described in detail. Author (GRA)

N71-29821 Illinois Inst. of Tech., Chicago.
EXPLOSIVE SYSTEM DESIGN FOR MAGNETIC FLUX COMPRESSION BY IMPLOSION
James Edward Kennedy (Ph.D. Thesis) 1970 308 p
Avail: Univ. Microfilms Order No. 70-14931

Initial magnetic fields of 10 to 50 kilogauss have been compressed to fields exceeding a megagauss by the implosion of tubular stainless steel liners driven by high explosives, using devices of two quite different designs. Of system employed a relatively thick annular cylindrical charge of Composition B or PBX-9404 which was initiated by a ring of 24 equiangularly spaced detonators. A second system the top hat configuration, was adapted from flux compression devices. In this device, flexible sheet explosive was wrapped about a thinner liner, initiated at one end perimeter and allowed to detonate along the liner wall. This design produced a conical implosion. The facilities, equipment, and techniques for these experiments requiring high voltage, high explosives, and microsecond synchronization are described in detail, emphasizing the explosive system design considerations and evaluation. Dissert. Abstr.

N71-29823# ARO, Inc., Arnold Air Force Station, Tenn.
RADIATIVE HEAT TRANSFER OF COATINGS ON A CRYOGENIC SURFACE Final Report, Oct. 1968 - Sep. 1970
Jeffrey A. Roux AEDC Apr. 1971 226 p refs
(Contract F40600-71-C-0002)
(AD-722720; ARO-VKF-TR-71-68; AEDC-TR-71-90) Avail: NTIS CSCL 20/13

An analytical model for the radiative characteristics of coatings formed on a cryogenic surface is presented. In creating a realistic mathematical model, six different sets of boundary conditions are employed in order to determine which most closely approximates the actual experimental results. The medium is considered to be absorbing and scattering; due to the cryogenic temperatures involved, emission is justifiably neglected. The scattering is considered as isotropic. To determine the best analytical model, the theoretical results are compared to experimental data in order to provide a test of the validity of the radiative transfer theory upon which the analytical predictions are based. Then using a combination of experimental results and the chosen analytical model, the monochromatic absorption and scattering coefficients for H2O and CO2 cryodeposits are simultaneously determined in the visible wavelength region. The results are demonstrated in the form of hemispherical-directional reflectance and intensity profiles within the medium. Also bidirectional reflectance distributions are presented and compared with experimental data. Author (GRA)

N71-29841*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTOR LINER FILM COOLING IN THE PRESENCE OF HIGH FREE-STREAM TURBULENCE
Albert J. Juhasz and Cecil J. Marek Washington Jul. 1971 50 p refs

(NASA-TN-D-6360; E-6135) Avail: NTIS CSCL 20M

Film cooling effectiveness data for various slot geometries were obtained using an instrumented liner installed in a rectangular sector of a gas turbine combustor. Because of high combustor free-stream turbulence, experimental film cooling effectiveness values were considerably lower than those predicted by several correlations currently in use. To improve prediction accuracy, a simple mixing model was developed which takes into account the turbulence level of the hot gas stream. This model adequately correlated the data of this report and also the low turbulence duct data of two references in the literature. Author

N71-29873# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.

IGNITION OF CHARCOAL ADSORBERS BY FISSION PRODUCT DECAY HEAT

R. P. Shields *In* AEC Proc. of the 11th AEC Air Cleaning Conf., Vol. 2 Dec. 1970 p 770-790 refs Sponsored by AEC (See N71-29851 17-13)

Avail: NTIS HC$6.00/MF$0.95

The problem of estimating maximum temperatures in a charcoal bed was set up so that the sensitive parameters, the insensitive parameters, the parameters that need to be measured and the parameters that might usefully be modified to increase the safety of a system can be clearly defined. A simple code was written which calculates maximum temperatures (or other temperatures) in a bed as a function of time and the pertinent parameters. The code is based on an infinite slab model and should be valuable because it is simple and is quite accurate at higher velocities. A more complicated computer code was also assembled which is based on a three dimensional model. This code enables one to mathematically describe a tray type charcoal adsorber quite accurately, including the heat sink and conduction paths offered by the steel screens and frames. This more detailed thermal analysis is required to estimate temperatures at very low gas flows. Both codes will soon be available. Author (NSA)

N71-29901*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROMOTION OF DROPWISE CONDENSATION OF ETHYL ALCOHOL, METHYL ALCOHOL, AND ACETON BY POLYTETRAFLUOROETHYLENE

Cecil E. Kirby Washington Jul. 1971 21 p refs

(NASA-TN-D-6302; L-7462) Avail: NTIS CSCL 20M

An experimental program was performed in which promotion of dropwise condensation of several organic vapors is achieved by coating a bare iron tube with polytetrafluoroethylene (teflon). Experimental overall heat transfer coefficients are presented for the dropwise condensation of ethyl alcohol, methyl alcohol, and acetone on the teflon coated tube and for filmwise condensation on the bare iron tube. The overall heat transfer coefficients achieved during dropwise condensation are approximately 30 percent greater for ethyl alcohol, 45 percent greater for methyl alcohol, and 85 percent greater for acetone than those during filmwise condensation. Carbon tetrachloride and trichlorofluoromethane were also condensed on the bare iron tube and on the teflon, but filmwise condensation occurred on both surfaces. A study of previously reported experimental results shows that aniline, ethylene glycol, and nitrobenzene also condense dropwise on a teflon surface, but benzene condenses filmwise. A comparison of the liquids mentioned shows that benzene and carbon tetrachloride are nonpolar whereas all the others are polar. Since all the polar liquids condensed dropwise and the nonpolar ones condensed filmwise on the nonpolar teflon surface, it is suggested that the dipole moment be investigated further as a possible parameter in predicting dropwise condensation of organic vapors. Author

N71-30117*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY INVESTIGATION OF GASEOUS EMISSIONS FROM JET ENGINE AFTERBURNERS

Larry A. Diehl Washington Jul. 1971 18 p refs

(NASA-TM-X-2323; E-6256) Avail: NTIS CSCL 20M

Gaseous emissions from jet engine afterburners were measured over a range of fuel-air ratios. The two configurations used were a full-size turbofan engine with an afterburner and a 51-cm diameter research afterburner. Nitric oxide emission did not increase with afterburning. The maximum nitric oxide concentration measured with afterburning was 3.4 g/kg of fuel burned while the maximum measured carbon monoxide emission was 1300 g/kg of fuel burned. Appreciable quantities of unburned hydrocarbons resulted from operation at high fuel-air ratios. Nitric oxide concentrations were less than theoretical equilibrium values by as much as two orders of magnitude; concentrations of unburned products were always greater than equilibrium values. Author

N71-30182*# Scientific Translation Service, Santa Barbara, Calif.

THE TIME COURSE OF COMBUSTION OF HYDROGEN IN SUPERSONIC AIR FLOW [DER ZEITLICHE ABLAUF DER VERBRENNUNG VON WASSERSTOFF IM UEBERSCHALL-LUFTSTROM]

Johannes Algermissen et al Washington NASA Jul. 1971 46 p refs Transl. into ENGLISH from Forsch. Ingenieurw. (West Germany), v. 36, no. 6, 1970 p 169-184

(Contract NASw-2035)

(NASA-TT-F-13719) Avail: NTIS CSCL 20M

The course of combustion was calculated and analyzed for different pairs of ignition temperature and ignition pressure in hydrogen-air mixtures flowing at supersonic velocity. The reaction-kinetic computer model considers 30 individual reactions between the 16 gas components H2, O2, N2, H2O, H, O, OH, HO2, H2O2, N, NO, NO2, N2O, HN, H2N, and HNO. The time courses of temperature, pressure, and composition, the velocity of the most important reactions, the flow velocity and the path distance covered by the flow medium are shown in numerous diagrams. The diagrams clarify the great dependence of the induction and combustion periods for the hydrogen-air mixture on the pressure and on the temperature at ignition. They indicate the parts played by the free atoms and radicals H, O, OH, HO2, etc. in the reaction mechanism. The computer results are compared with ignition delay measurements from various studies. Author

N71-30286# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

FILM COOLING PRESENTATION TO EUROMECH 19

O. C. Ledford Mar. 1971 18 p refs

(IC-Aero-71-07) Avail: NTIS

A summary of results and conclusions of film cooling research is presented. The work covered includes low speed flow as well as high speed laminar and turbulent flows. A range of coolant gases was investigated. Several generalizations and hypotheses are put forward regarding the phenomena of film cooling. Author

N71-30287# Technische Hogeschool, Eindhoven (Netherlands).

THE ROLE OF THE EVAPORATING MICROLAYER AND DRY SURFACE AREAS IN BOILING

Hendrik Jacob Van Ouwerkerk (Ph.D. Thesis) 1970 111 p refs

Avail: NTIS

A mathematical analysis of the processes of heat transfer, boiling, and evaporation is presented. Subjects discussed are: (1) film boiling, (2) bubble nucleation, (3) theory of rapid bubble growth at liquid-solid interface, (4) application of theory to nucleate pool boiling, and (5) dry areas and stability of nucleate and film boiling. Author

N71-30288*# National Aeronautics and Space Administration. Washington, D.C.

NATURAL CONVECTION HEAT TRANSFER IN BOILING OF METALS

V. I. Subbotin et al Jun. 1971 192 p refs Transl. into ENGLISH of the book 'Teploobmen Pri Kipenii Metallov v Usloviyakh Yestestvennoy Konvektsii' Moscow, Nauka, 1969 p 1 206
(NASA-TT-F-620) Avail: NTIS CSCL 20M

For a better understanding of the mechanism of boiling in general, a comparison is performed of the processes of boiling of metals and non-metallic liquids. During the investigation of heat transfer in boiling of metals, electronic heating was used, making it possible to produce practically unlimited specific heat flow. Author

N71-30304# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
KINETICS OF OXIDATION AND QUENCHING OF COMBUSTIBLES IN EXHAUST SYSTEMS OF GASOLINE ENGINES Final Report, 24 Feb. 1969 - 23 Feb. 1970
Donald J. Patterson, B. Carnahan, R. H. Kadlec, H. A. Lord, and J. J. Martin Dec. 1970 92 p refs
(Contract PHS-CPA-22-69-51-HEW)
(EPA-CPA-22-69-51-HEW) Avail: NTIS CSCL 21B

The project investigated reaction kinetics and physical processes including mixing in thermal reactor systems. Baseline data of various species were collected on an engine for various engine operating conditions. The results are not complete on work to obtain information on concentrations of chemical species in the reactor which will aid in better reactor design. A computer model of reactions occurring in the reactor is being constructed. GRA

N71-30348*# Mathematical Applications Group, Inc., White Plains, N.Y.
NONLINEAR COMBUSTION INSTABILITY IN LIQUID-PROPELLANT ROCKET MOTORS Final Report
Samuel Z. Burstein, Wallace Chinitz, and Harold S. Schechter Dec. 1970 248 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951946; Proj. 6709)
(NASA-CR-119182; MR-6903) Avail: NTIS CSCL 21B

Two mathematical models are presented which describe, to a certain degree of approximation, the main physical processes that occur in liquid propellant rocket motors. A paricake model describes some of the gas dynamic processes in the transverse (r-theta) plane of a cylindrical chamber. The annular model is able to describe gas dynamic and drop spray interaction processes in the cylindrical space described by theta-z coordinates. Both models are time dependent. However, the r-theta model seeks to describe the complicated nonlinear motion of gas dynamic waves in the spinning or sloshing mode near the injector face of the motor. The annular model seeks to describe the interaction of a reacting drop spray with finite amplitude waves which move both tangentially as well as axially. The annular model also includes the effects of a converging-diverging nozzle on the flow field. Author

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-29256# Civil Aeronautics Board, Washington, D.C.
REMARKS PREPARED FOR DELIVERY BY THE HONORABLE SECOR D. BROWNE, CHAIRMAN, CIVIL AERONAUTICS BOARD, BEFORE THE AVIATION DAY LUNCHEON, SEATTLE CHAMBER OF COMMERCE
Secor D. Browne Oct. 1970 13 p Luncheon held in Seattle, 29 Oct. 1970
Avail: Issuing Activity

Air carriers' problems and areas where the Civil Aeronautics Board and the carriers can take corrective steps are discussed. Capacity, fare increases, the expense which would result from retrofitting if required for protecting the environment, the necessity to improve controls for preventing hijacking, and uncoordinated access transportation are considered, and areas in which the carriers might cut costs are indicated. The problems of local airline service and subsidy, and of supplemental air carriers are described. The impact of the carriers' financial health on the aircraft industry and the need to have a strong R and D program for advanced aircraft such as the SST and short-haul aircraft are also covered. N.E.N.

N71-29259# Bureau of Mines, Washington, D.C.
A PRACTICAL APPROACH TO CUTOFF SAMPLING FOR REPETITIVE SURVEYS
Katherine Harding and Arthur Berger Jun. 1971 20 p
(BM-IC-8516) Avail: Issuing Activity

A description is given of a practical approach to sampling that does not require elaborate statistical techniques. Simple steps are given for finding a cutoff point in the response from a repetitive survey. This procedure can be used to estimate the aggregate value of the characteristic being measured without waiting for a complete count from the survey. This is a useful technique when the reference periods are repeated at frequent intervals, such as monthly and quarterly, and when the statistical collecting agency is engaged in publishing timely data which must be accurate economic indicators. Author

N71-29285# Southampton Univ. (England). Transportation Research Group.
INTER-CITY VTOL STUDIES (UK) BUSINESS TRAFFIC AND POTENTIAL SITES. VOLUME 1: BUSINESS TRAFFIC Final Report
Aug. 1969 158 p ref
(Contract PD/40/052)
(AE-326/021-Vol-1) Avail: NTIS

The surveys and analyses which were made of business travel from establishments in eight urban areas in the United Kingdom are presented. The studies were undertaken to determine the economic feasibility of establishing a vertical takeoff and landing airline operation. The basic trip characteristics of business travelers and the relationships of trip generation and distribution are discussed. Author

N71-29288# Southampton Univ. (England). Transportation Research Group.
INTER-CITY VTOL STUDIES (UK) BUSINESS TRAFFIC AND POTENTIAL SITES. VOLUME 2: POTENTIAL SITES Final Report
Aug. 1969 247 p ref
(Contract PD/40/052)
(AE-326/021-Vol-2) Avail: NTIS

Feasibility studies and analyses associated with potential sites for VTOL terminals in eight selected urban areas within the United Kingdom are presented. Analyses were made of the proposed land use patterns, population, employment, communications, and traffic to identify a number of possible VTOL sites. It is concluded that a number of potential sites for VTOL terminals are available and that VTOL commercial air transportation is feasible. Author

N71-29386# Committee on Appropriations (U.S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT; SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATION BILL, 1972
Boland Washington GPO 1971 41 p refs Report to accompany H.R. 9382 presented to the Comm. of the Whole House on the State of the Union by the Comm. on Appropriations, 92d Congr., 1st Sess., 23 Jun. 1971
(Rept-92-305) Avail: US Capitol, House Document Room

The recommendations by the House Committee on Appropriations for fiscal year 1972 are reported. Budget estimates, budget requests and 1971 appropriations are included for the following agencies: Department of Housing and Urban Development, Commission of Population Growth and the American Future, Federal Communications Commission, Federal Home Loan Bank Board, NASA, National Science Foundation, Office of Science and Technology, Renegotiation Board, Securities and Exchange Commission, Selective Service System, and the Veterans Administration. F.O.S.

N71-29399# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 255
28 Jun. 1971 61 p Transl. into ENGLISH from Russian reports (JPRS-53471) Avail: NTIS

CONTENTS:

1. ASTRONOMY p 1–8 (See N71-29400 17-30)
2. METEOROLOGY p 9–22 (See N71-29401 17-20)
3. OCEANOGRAPHY p 23–40 (See N71-29402 17-13)
4. TERRESTRIAL GEOPHYSICS p 41–48 (See N71-29403 17-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 49–55 (See N71-29404 17-13)

N71-29422# Technische Univ., Berlin (West Germany). Inst. fuer Raumfahrttechnik.
THE BENEFIT OF SPACE RESEARCH FROM THE GERMAN POINT OF VIEW. A MACRO MODEL FOR ESTIMATING THE MAGNITUDE OF SPACE RESEARCH BENEFITS FOR THE FEDERAL REPUBLIC OF GERMANY, PART 3B [UEBER DEN NUTZEN DER WELTRAUMFORSCHUNG AUS DEUTSCHER SICHT. EIN MAKROMODELL FUER DIE ABSCHAETZUNG DER GROESSENORDNUNG DES AUS DER WELTRAUMFORSCHUNG ABLEITBAREN NUTZENS FUER DIE BRD]
Heinz-Hermann Koelle, Gerd Ehinger, Frank Heidtmann, Fritz Lienemann, Goetz Niederau et al Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Jan. 1971 209 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-04-Pt-3) Avail: NTIS; ZLDI Munich: 43.70 DM

A cost benefit model for space programs of the German Federal Republic is developed. The purpose of the model is to provide a decision aid for planning the German space program. The aim of this effort is to determine the benefit of space projects in their magnitude and trends. Furthermore the cost benefit ratios of alternative space programs are investigated and described. The proposed projects are described along with the inquiries carried out throughout this project and used computer programs as well as an extensive bibliography are listed. Author (ESRO)

N71-29471# Committee on Public Works (U.S. Senate).
SOME ENVIRONMENTAL IMPLICATIONS OF NATIONAL FUELS POLICIES
Washington GPO 1970 74 p refs Presented by Comm. on Public Works, 91st Congr., 2d Sess., Dec. 1970
Avail: SOD $0.30

An objective analysis of the factors relevant to the development of fuels and energy policies compatible with environmental quality requirements is presented as a staff report to the Chairman of the Committee on Interior and Insular Affairs. Based on the expected population growth, the energy and fuel requirements are projected to the year 2000. Techniques and processes for pollution control are discussed, and the expenditures for pollution research are summarized for FY 1969, 1970, and 1971. F.O.S.

N71-29648# RAND Corp., Santa Monica, Calif.
MEETING TOMORROW'S LOGISTICS CHALLENGES WITH NOW RESEARCH
Donald E. Lewis and Thomas T. Tierney Mar. 1971 33 p refs Presented at the Worldwide Materiel Conf., McClellan AFB, Calif., 28–29 Oct. 1970
(Contract F44620-67-C-0045)
(AD-722420; R-686-PR) Avail: NTIS CSCL 15/5

Documentation is made of a presentation before the Worldwide Materiel Conference that discusses the value of current logistics research in reducing future uncertainties and risks and in describing future consequences of present resource commitments. Past research on METRIC, on air transport of recoverable items, on scheduled maintenance, and on repair tradeoffs between base and depot are cited as examples of relevant research. Three studies have implications for the future: remotely piloted systems; force capability reporting; and aircraft maintenance scheduling policy. Author (GRA)

N71-29633# Helsinki Univ. (Finland). Radio Lab.
SPACE ACTIVITIES IN FINLAND IN 1970
Martti Tiuri ed. and Seppo Urpo ed. 1971 10 p refs
(Rept-S-39-1971) Avail: NTIS

Space activities in Finland during 1970 are listed in fields of sounding rockets, space technology, ionosphere and magnetosphere research, lunar research, satellite geodesy, life sciences, satellite tracking, and telemetry and acquisition facilities. ESRO

N71-29660# Matrix Research Co., Falls Church, Va.
DESIGN OF A COMPUTER ASSISTED COASTAL INFORMATION SYSTEM. PHASE 3: MODELING THE NAVY ECOSYSTEM Final Report, 12 Jan. 1970–21 Apr. 1971
Robert D. Campbell and A. L. Roark 21 Apr. 1971 74 p refs
(Contract N00014-70-C-0215)
(AD-722427) Avail: NTIS CSCL 15/4

In this research effort our goal has been to determine what kind of information system about coastal areas would meet some large spectrum of Navy needs. In previous reports we reached the conclusion that to accomplish this goal we would need to construct some kind of model of the Navy ecosystem. We suggested that the bases for such a model be real information from the Navys record of interactions among coastal environments, Navy weapons systems, and basic Navy functions. We therefore used as source data the reports and publications of Navy activities associated with design, development, test, and evaluation of weapons systems and their components. Our objective was to describe the Navy ecosystem in rigorous enough fashion that our model would provide the logic for a coastal information system. Our model is therefore expressed in three ways: verbally, mathematically, and in information systems terms. The purpose of all these expressions of the same model is to provide the bases for an aggregating, integrating process which will relate environment to naval weapons systems in terms of naval functions. We believe that the structure we have described provides the framework for information systems not only for Navy but also for a wide gamut of evaluation and design activities which concern the man-environment interaction. Author (GRA)

N71-29707# Committee on Interstate and Foreign Commerce (U.S. House).
AIR FARES AND CHARTER SERVICE
Washington GPO 1970 605 p refs Hearings before Comm. on Interstate and Foreign Com., 91st Congr., 2d Sess., 10 Aug., 15–17 Sep., and 9 Oct. 1970 As Serial No. 91-80
Avail: Subcomm. on Transportation and Aeron.

The hearings concerning problems of ticketed and charter services are reported. The CAB charter regulations concerning the requirements for legitimate chartering organizations are discussed. The cost report of the International Air Transport Association is

included, and charter flights to the United States by foreign airlines are also discussed. F.O.S.

N71-30049*+ California Univ., Berkeley. Space Sciences Lab.
SYSTEMS ANALYSIS AND ORGANIZATION THEORY: A CRITIQUE
C. West Churchman Jun. 1971 13 p refs *Its* Intern. Working Paper No. 3
(Grant NGL-05-003-404)
(NASA-CR-119178) Avail: NTIS CSCL 05B

A brief description of the basic methodology and philosophy underlying the normative technique approach to the study of organizations, is given. Author

N71-30164# Committee on Commerce (U.S. Senate).
WATERFRONT AND AIRPORT COMMISSION COMPACT ACT OF 1970
Magnuson Washington GPO 1970 13 p refs Report to accompany S. J. Res. 222 presented by Comm. on Com. at 91st Congr., 2d Sess., 2 Oct. 1970
(Rept-91-1262) Avail: US Capitol, Senate Document Room

Hearings are presented on legislation which would extend the authority of the Waterfront Commission of New York Harbor to airports in the New York metropolitan area to reduce air cargo theft. The proposed bill provides the Commission with authority to license airfreightmen and airfreightman supervisor, and to declare an area in an airport as an airfreight security area. Arguments advanced by the opponents and rejoinders by proponents are summarized. The modus operandi in the thefts, weaknesses in the bill, and suggestions to strengthen the bill are described. N.E.N.

N71-30165# Committee on Interior and Insular Affairs (U.S. Senate).
FUELS AND ENERGY
Washington GPO 1970 262 p refs Hearings on S. 4092 before Comm. on Interior and Insular Affairs, 91st Congr., 2d Sess., 10-11 Sep. 1970
Avail: Subcomm. on Minerals, Mater., and Fuels

Public hearings on September 10-11, 1970 before the Senate Subcommittee on Minerals, Materials, and Fuels regarding a bill to establish a Commission on Fuels and Energy are reported. The purpose of such a commission is to recommend programs and policies to insure the U.S. requirements for low cost energy are met and to reconcile environmental quality requirements with future energy needs. A.C.R.

N71-30166# Committee on Aeronautical and Space Sciences (U.S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1972
Washington GPO 1971 111 p refs Report on H.R. 7109 presented by the Comm. on Aeron. and Space Sci., 92d Congr., 1st Sess., 8 Jun. 1971 *Its* Calendar No. 142
(Rept-92-146) Avail: US Capitol, Senate Document Room

NASA authorizations for FY 1972 are presented in a report of the Senate Committee on Aeronautical and Space Sciences. Appropriations are included for research and development, construction of facilities, and space program management. A.C.R.

N71-30183*# National Aeronautics and Space Administration, Washington, D.C.
TESTING METHODS AND TECHNIQUES: A COMPILATION
1970 17 p
(NASA-SP-5921(01)) Avail: NTIS CSCL 13H

Technology is presented representing testing methods and techniques that have evolved from a number of space programs. The compilation covers a selected group of nondestructive tests for materials, welds, valves and tubing, wire insulation, bearings, and instrumentation fittings. Other tests include means for determining gas contamination, detecting hydrogen fires, detecting leakage in pressure transducers, and conducting shock tests of large items. Several computer programs that may be applicable to industrial testing are also presented. The information is intended primarily for skilled technicians and engineers with practical experience in quality control, inspection, and industrial testing. Author

N71-30276# National Science Foundation, Washington, D.C.
FEDERAL FUNDS FOR ACADEMIC SCIENCE, FISCAL YEAR 1969
Feb. 1971 33 p refs
(NSF-71-7) Avail: SOD $1.00

Ten Federal agencies reported a total of $2,314 million for academic science activities during fiscal year 1969, representing virtually the same level of Federal funding of academic science as reported for fiscal year 1968. In most program areas the Department of Health, Education, and Welfare (HEW) was the primary source of funds, accounting for a total of $1,245 million, or more than one-half of all obligations from the Federal Government. The National Science Foundation (NSF) with $362 million, or nearly one-sixth of the Federal-wide total, was second in sponsorship of academic science activities. Other agencies contributing significant shares of academic science support in 1969 were the Department of Defense (DOD), $272 million; the Department of Agriculture (USDA), $155 million; the National Aeronautics and Space Administration (NASA), $125 million; and the Atomic Energy Commission (AEC), $121 million. Author

N71-30277# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEVERAL PROBLEMS OF ORGANIZATION OF SCIENCE IN THE EPOCH OF THE SCIENTIFIC-TECHNICAL REVOLUTION
M. K. Petrov 2 Feb. 1971 29 p Transl. into ENGLISH from Vopr. Filosofii (USSR), v. 22, no. 10, 1968 p 36-45
(AD-722307; FTD-MT-24-235-70) Avail: NTIS CSCL 5/9

The article discusses productivity of purely scientific work as opposed to industrial production. It is underlined that whereas mass production involves a repetition of single acts, and productivity can increase as the manufacturing process improves, purely scientific work forbids repetition of a single productive act. The organization of science requires further study if its productivity is to be correctly judged. GRA

N71-30301# General Accounting Office, Washington, D.C. Office of Comptroller General.
ADVERSE EFFECTS OF PRODUCING DRONE ANTISUBMARINE HELICOPTERS BEFORE COMPLETION OF DEVELOPMENT AND TESTS Department of the Navy, B-160877: Report to Congress
Elmer B. Staats 31 Dec. 1970 51 p refs
Avail: NTIS

The problems encountered in operational deployment of the QH-50 drone helicopter by the U.S. Navy are discussed. The causes for the excessive loss rate are examined and corrective actions are recommended. The primary cause for failure is reported to be the result of procuring the helicopter before completion of development and flight test. Author

N71-30322# Eurospace, Paris (France).
EUROPE AND THE FUTURE INTELSAT STATUTES
Nov. 1969 49 p
Avail: NTIS

Ever since the formation of Intelsat, European industry has continued to demand a greater participation in the work of implementing the Organization's program, but it is first necessary to inject an element of organization into its space programs. In this

memorandum the European space problem is examined and reasons for reforming Intelsat put forward. Areas for setting up world and regional communications systems are considered and the management and government/industry relations analyzed in light of a proposed new organization. ESRO

N71-30358# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ELECTRON AND SOLID STATE PHYSICS, CONTROL THEORY, AND ANTENNA RESEARCH Semiannual Progress Report, 1 Jul. – 31 Dec. 1970
Apr. 1971 87 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-722415; SAPR-81) Avail: NTIS CSCL 20/12

Very low frequency wave propagation, Electron and solid state physics, Control theory and applications, Electronic networks and instrumentation, Physics of ferromagnetic and ferroelectric materials, Electromagnetic phenomena, Coupled antennas and arrays, Antennas and waves in dies and transmission lines. GRA

N71-30368* + California Univ., Berkeley. Space Sciences Lab.
CAN A MANAGER TEACH AN AUTOMATED INFORMATION SYSTEM?
C. West Churchman May 1971 12 p Presented at TIMS 18 Intern. Meeting, Washington, D.C., 22 Mar. 1971 *Its* Internal Working Paper No. 2
(Grant NGL-05-003-404)
(NASA-CR-119180) Avail: NTIS

The problems associated with programming a computer to make management decisions are discussed. The inventory control decision is used as a basic example, and an adaptive mode for the computer to learn about the world of a manager is described. It is felt that many recent advances in psychology must be incorporated into the understanding of how a management information system should work. N.E.N.

N71-30396*# Denver Research Inst., Colo.
PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Quarterly Report, 1 Jul. – 31 Dec. 1970
James P. Kottenstette, James E. Freeman, and Eileen R. Staskin
9 Mar. 1971 102 p
(Contract NSR-06-004-063)
(NASA-CR-119183; QR-3; QR-4) Avail: NTIS CSCL 05B

A summary of research activities of the Project for the Analysis of Technology Transfer (PATT) is presented for July through Dec. of 1970. In addition, a major program modification in the area of PATT transfer documentation is reported. While retaining an emphasis on documenting individual cases of technology transfer activities, the new approach groups particular transfer activities into selected technical fields and describes those activities in transfer profile presentations. Three individual summaries of technology transfer are given that include reports involving NASA generated plastics, lubrication, and contamination control technology. D.L.G.

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